

AR1086

AMENDMENT #2

to the

RECORD OF DECISION

for the

SOIL AND GROUND WATER OPERABLE UNIT

KOPPERS COMPANY, INC. SUPERFUND SITE
OROVILLE, CALIFORNIA

U.S. Environmental Protection Agency
Region 9
San Francisco, California

September 23, 1999

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PART 1: THE DECLARATION

A. Site Name and Location

Koppers Company, Inc.
Oroville, California

B. Statement of Basis and Purpose

This decision document presents the U.S. Environmental Protection Agency's (EPA's) amended selected remedial actions for contaminated groundwater at the Koppers Company, Inc. (Koppers) site in Oroville, California, which were chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The State of California concurs with the selected amendments to the remedy.

C. Assessment of Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the Record of Decision (ROD), as modified by this ROD Amendment, may present an imminent and substantial endangerment to public health, welfare, or the environment.

D. Description of Selected Remedy

This ROD Amendment modifies the previously selected remedy for contaminated groundwater at the Koppers site. The revision affects both the cleanup standards and the cleanup technologies selected in the 1989 ROD for the site's single operable unit. This ROD Amendment does not affect the soils remedy selected in the August 1996 ROD Amendment. The 1989 ROD specified Pump and Treat (P&T) as the groundwater remedy and a P&T facility was installed both on and off-property to achieve groundwater restoration for drinking water use.

Amendment #2 to the ROD provides for 1) a Technical Impracticability (TI) Waiver due to Dense Nonaqueous-Phase Liquid (DNAPL) contamination, 2) adding enhanced *in-situ* bioremediation to the remedy to augment pentachlorophenol (PCP) destruction, and 3) adding Monitored Natural Attenuation (MNA) as a contingency remedy should enhanced *in-situ* bioremediation nutrient distribution not be fully achieved in the aquifers. The major components of the revised groundwater remedy are as follows:

■ Technical Impracticability Waiver

The nature and extent of DNAPL impacts at the Koppers site are better understood now than they were when the Remedial Investigation/Feasibility Study (RI/FS) was completed. The factual presentation providing the basis for a TI Waiver is documented in the "Final Evaluation of Technical Impracticability of Groundwater Restoration in the Former Creosote Pond and CELLON BLOWDOWN Areas" submittal dated March 8, 1999, which will be referred to as TI Evaluation Reference "A". The described four-acre area of the 200-acre site composed of the former creosote pond area and CELLON BLOWDOWN area will be referred to as the TI Zone. Based on TI Evaluation Reference "A" and site monitoring data, the EPA has concluded that the existing P&T remedy and/or presently available technology will not restore the aquifer within the TI Zone to meet the groundwater cleanup standards of the 1989 ROD even though surface and near surface source material have been removed. The principal threat wastes to groundwater in the TI Zone are polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDDs/PCDFs) which will be referred to as dioxin, and high concentration carcinogenic and non-carcinogenic Polynuclear Aromatic Hydrocarbons (cPAH & PAH) all present in DNAPL. The low-level threat waste in the TI Zone DNAPL is pentachlorophenol (PCP). This ROD amendment documents a waiver of the groundwater cleanup standards for the TI Zone based on the EPA's conclusion that it is technically impracticable from an engineering perspective, to achieve the groundwater cleanup standards in the TI Zone. The major components of the TI Waiver are as follows:

- sampling of monitoring wells for Contaminants of Concern (COC) both within the TI Zone and down-gradient;
- installation of one new monitoring well down-gradient of the TI Zone;
- develop an acceptable contingency plan to maintain the P&T facility and resume its operation if the EPA determines that a contaminant is leaving the TI Zone;
- implementation of institutional controls through land use covenant deed restrictions to prevent exposure to contamination remaining in the TI Zone, to prohibit drilling of wells within the TI Zone for purposes other than monitoring or remedial activities, to prohibit use of groundwater within the TI Zone except for wood-treating operations, and to limit future land use to industrial; and
- continued operation of the existing Product Recovery well (PR-1) and the PAH *in-situ* groundwater bioremediation well (BW-1) until creosote recovery is less than one gallon per year at PR-1.

■ Enhanced *in-situ* Bioremediation

Based on general PCP wood treating site data and site specific data, the EPA has concluded that the restoration of groundwater for use as a public drinking water supply outside the TI Zone could be expedited significantly if enhanced *in-situ* bioremediation were added to the remedy to remediate PCP both on and off-property. Off-property the only COC is low-level threat waste PCP. On-property and outside the TI Zone, the COC above the groundwater cleanup standards are low-level threat wastes boron and PCP. The major components of the enhanced *in-situ* bioremediation are as follow:

- nutrient addition (primarily oxygen, nitrogen and phosphorus) to existing wells on and off-property to provide optimum conditions for PCP degradation, in conjunction with monitoring down-gradient;
- continued operation of the existing on-property P&T to restore groundwater outside the TI Zone and prevent contaminate migration off-property;
- annual evaluation and adjustment, as needed, to enhance bioremediation;
- due to nutrient addition to monitoring well RI-11 the alternative water supply termination criteria (AWSTC) for water supply wells 59, 60, 61, 62 and 81 is modified as follows: 1) verification sampling for PCP to end the subsidy cannot be conducted until nutrient addition in the area of these wells has been terminated and nutrient levels have returned to background levels for at least one year and 2) to end the subsidy for each individual drinking water well the PCP level must be less than 0.5 ppb for four consecutive quarters.

If the EPA determines enhanced *in-situ* bioremediation will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

■ Monitored Natural Attenuation As Contingency Remedy

Site data has shown that PCP degradation occurs naturally both on and off-property. Provision is made for implementing MNA as a contingency remedy outside the TI Zone if the EPA determines that 1) enhanced *in-situ* bioremediation nutrient distribution cannot be adequately achieved, 2) other active restoration measures are not necessary, 3) site conditions continue to demonstrate that PCP degradation is occurring, and 4) natural attenuation is expected to achieve cleanup levels within a reasonable time frame achievable by a treatment remedy. Groundwater monitoring data will be submitted to the EPA for review until cleanup standards are achieved in accordance with an approved monitoring plan. If the EPA determines MNA will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

E. Statutory Determinations

The selected remedy is protective of human health and the environment, complies with the requirements of CERCLA Section 121 for a waiver of federal and State requirements in the TI Zone that are legally applicable or relevant and appropriate, complies with the federal and State Applicable or Relevant and Appropriate Requirements (ARARs) that are not subject to the waiver (the groundwater outside the TI Zone) and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practical for this site. The revised groundwater remedies utilize both containment and treatment technologies to reduce toxicity, mobility, or volume of contaminants. However, because treatment of the DNAPL in the TI Zone was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy for groundwater in the TI Zone.

Because the TI Waiver will result in hazardous substances remaining on-site above health-based levels, the EPA will conduct a review pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c), within five years of commencement of this amended remedial action to insure that the remedy continues to provide adequate protection of human health and the environment.

F. Data Certification Checklist

The Declaration certifies that the following information is included in the ROD amendment:

- COC and their respective concentrations;
- baseline risk represented by the COC;
- cleanup levels established for the COC and the basis for these levels;
- how source materials constituting principal threats are addressed;
- current groundwater use assumptions used in the baseline risk assessment and ROD;
- potential groundwater use that will be available at the site as a result of the Selected Remedy;
- estimated capital, operating and maintenance (O&M), and total present worth; discount rate; and the number of years over which the remedy cost estimates is projected; and
- key factor(s) that led to selecting the remedy.

G. Authorizing Signature

9-23-99

Date

Keith Takata

Keith Takata
Director, Superfund Division

PART 2: THE DECISION SUMMARY

A. Site Name, Location, and Brief Description

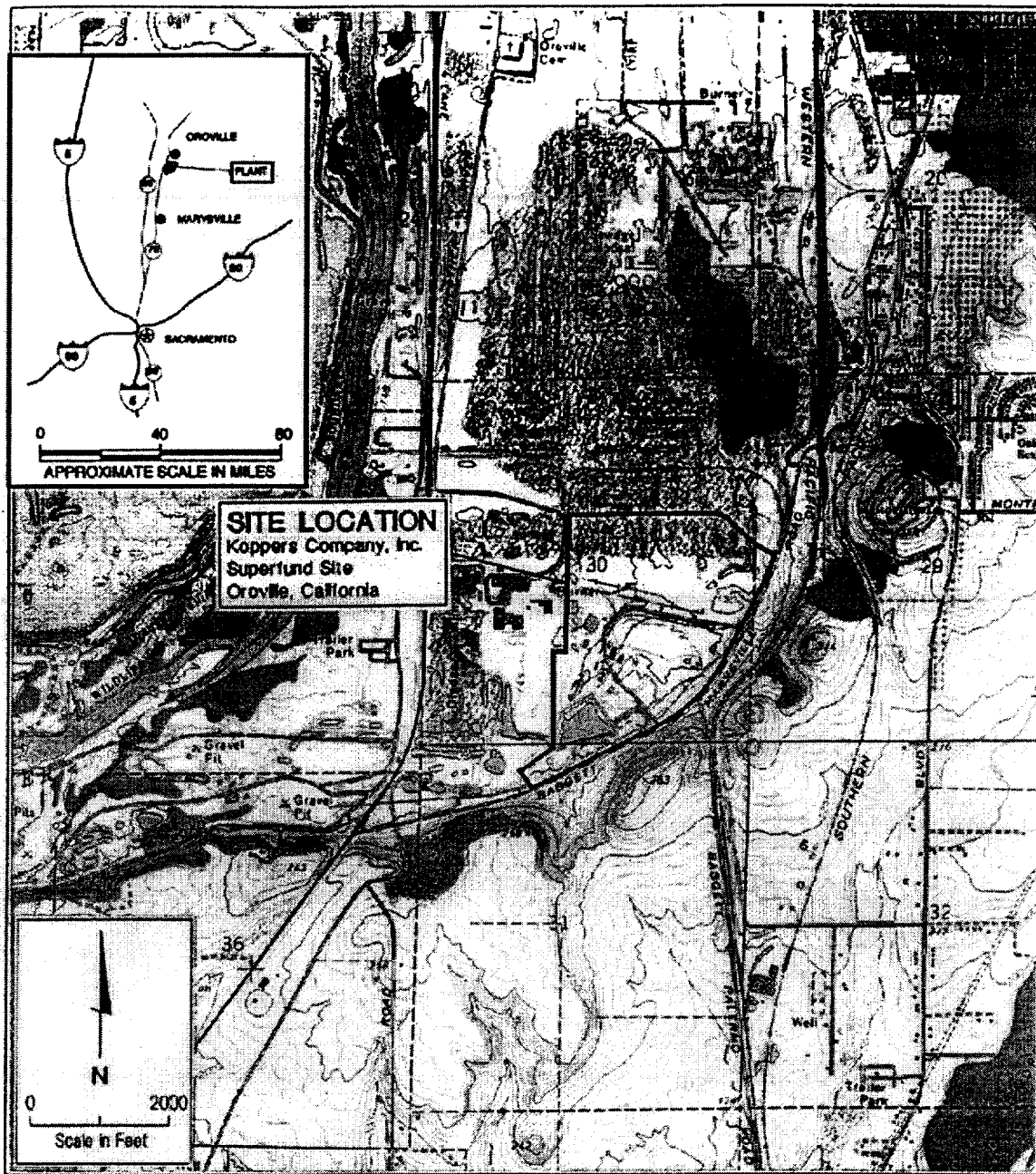
The Koppers Company Superfund site is located in Butte County just south of the city limits of Oroville, California (see Figure 2A-1). The site's Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) identification number is CAD009112087. The lead-agency for the site is the EPA. The site type is an active industrial wood treating facility with groundwater contamination on property and extending to the south of property (see Figure 2A-2). The Koppers plant lies in the flood plain about 3000 feet east of the Feather River, on the fringe of an area where dredge mining operations occurred in the early 1900s. The Koppers plant is bordered on the west by the Louisiana-Pacific Corporation facility, which has been removed from the National Priority List (NPL) as a Superfund site.

Land use in the vicinity of the site is mixed industrial, commercial, agricultural and residential. Residential areas are outside a buffer of industrial and commercial areas directly adjacent to the site. The geology underlying the site consists of gravels, sands and clays that were deposited by the Feather and ancestral Feather River systems. In the northern portion of the Koppers property, the soils have been disturbed by dredge mining operations. Interconnecting aquifer zones A, B-Upper, B-Lower and C have been identified on and off-site (see Figure 2A-3). The regional groundwater flow is generally to the south.

B. Site History of Contamination and Selected Remedy

Hutchinson Lumber Mill owned the Oroville, California property prior to 1948. In 1948, the National Wood Treating Corporation acquired the property and began wood treating operations. Georgia-Pacific acquired the site in 1951, and Koppers Co., Inc. acquired the site from Georgia-Pacific in 1955. Beazer East, Inc. (BEI) purchased Koppers Co., Inc. between June and November 1988. In December 1988, BEI subsequently sold the assets of its Tar and Treated Wood Sector, including the Oroville, California plant operations and property, to a management buy-out group known as Koppers Industries, Inc. (KII). KII continues to operate the plant today, however, BEI retained responsibility for the environmental cleanup issues at the site.

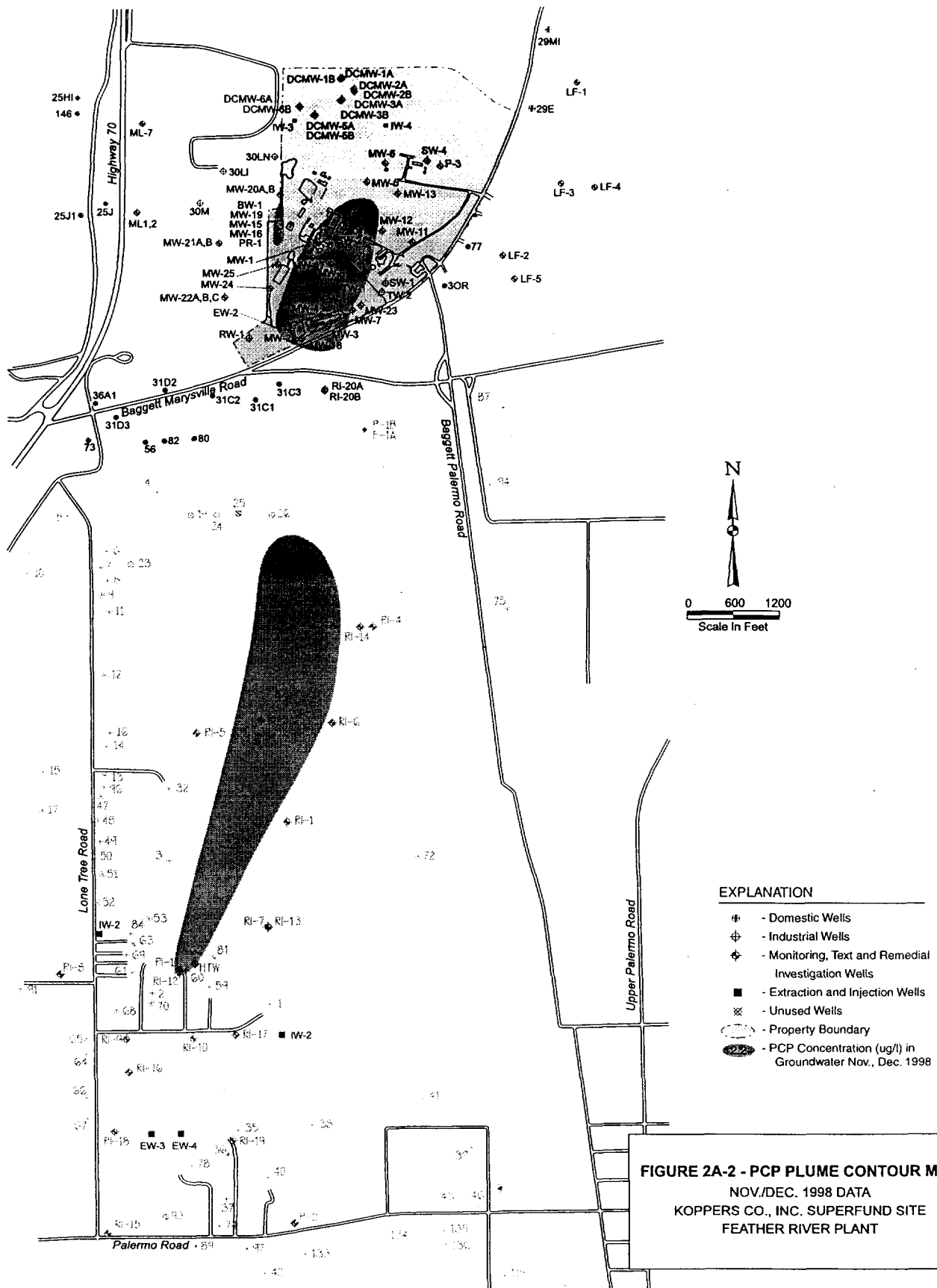
The Koppers facility encompasses approximately 200 acres and has been used for wood treating operations since 1948. Historically, wood poles and ties have been pressure treated with PCP, creosote, and inorganic formulations, including chromium and arsenic. Soil and groundwater contamination at the site have resulted from both past wood treatment operations and related waste disposal practices. A fire occurred in the CELLON process area in 1963 and again in 1987. The State identified the Koppers site as an environmental problem during the early 1970's when constituents associated with wood treatment activities were identified at the site in soils and groundwater. The site was placed on the NPL in 1984. Koppers began the Remedial Investigation (RI) in April 1986 and submitted the RI in July 1988. Use of PCP was discontinued at the site in 1988. In November 1988, the EPA completed the Endangerment

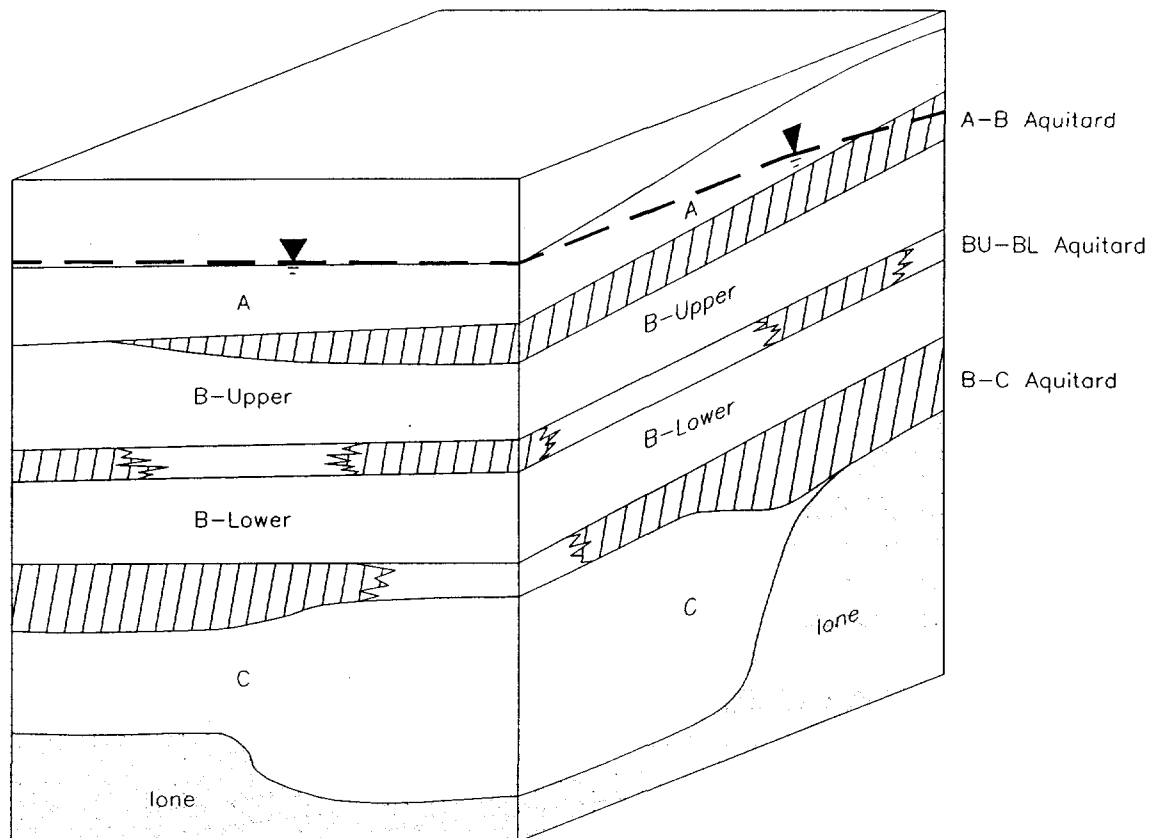


REFERENCE: USGS 7.5' Quadrangle, Palermo, CA, 1980



FIGURE 2A-1 - SITE LOCATION
KOPPERS CO., INC. SUPERFUND SITE
FEATHER RIVER PLANT





Explanation





-  Silt and Clay
-  Sand and Silt
-  Gravels
-  Static Water Level

Figure Based on: Dames & Moore, 100% Design Report Initial Phase On-Property Groundwater Remediation System, July 1993

FIGURE 2A-3 - AQUIFERS SECTION
KOPPERS CO., INC. SUPERFUND SITE
FEATHER RIVER PLANT

Assessment (EA). In May 1989, a Feasibility Study (FS) was conducted to evaluate a wide range of soil and groundwater cleanup alternatives.

In September 1989, the EPA issued a ROD for the site. The groundwater remedy specified to restore groundwater to drinking water standards was pump and treat. In January 1991, the EPA issued an Explanation of Significant Difference (ESD) to clarify the ROD. The ESD specified that the existing remedial objectives for soil remain in effect for surface soils down to a depth of five (5) feet below ground surface and included institutional control actions as part of the remedy for soil and groundwater. Under the EPA's oversight, BEI is currently performing the cleanup work under the terms of a Consent Decree, signed in February 1992. BEI began design work for the groundwater remedy in 1990 and started construction of the first groundwater treatment plant in late 1992.

In 1996, the EPA issued ROD Amendment #1 modifying and clarifying certain features of the 1989 ROD. The site cleanup standard was changed from residential use to industrial. With the change in land use the soil remedy was changed to place contaminated soil in a second on-site landfill with a capacity of 145,000 cubic yards. With the exception of an estimated 20,000 cubic yards of soil in the process area, the soil remedy is complete. The 1996 ROD allows the remaining contaminated soil to remain until either the process equipment is replaced or wood treating ceases. The EPA has no forecast date for Koppers replacement of their process equipment or a date when wood treating operation will cease at the site to allow completion of the soil remedy.

On-Property Groundwater Treatment

The on-property P&T system was designed to prevent contaminated groundwater from flowing off the Koppers site by pumping groundwater from beneath the Koppers site, treating the water to the cleanup standards established by the EPA in the 1989 ROD and returning the water to the groundwater basin. In February 1994, a four hundred (400) gallons per minute (g.p.m.) on-property P&T system began operation and continues to operate today. The monitoring data for wells RI-20A and RI-20B confirm that the on-property P&T system is effectively capturing the on-property contamination plume. The P&T system prevents further contaminated groundwater from migrating south of the Koppers facility to feed the off-property plume. Due to the efforts of the P&T system, the original plume has separated into two plumes designated on-property and off-property. The PCP levels, the major COC, entering the P&T system have significantly reduced from 350 parts per billion (ppb) in February 1994 to approximately 35 ppb to date. The EPA expects groundwater contamination to continue to decrease based on the soil remediation conducted in 1996 and 1997.

A product recovery well (PR-1) was installed in September 1994 on-property at the former creosote pond area to assist in creosote recovery. In July 1995, BEI installed a pilot *in-situ* groundwater biotreatment system to aid in creosote degradation near PR-1. In a little more than four years of operation, the on-property product recovery well PR-1 has removed

approximately 160 gallons of creosote and an additional 220 gallons of creosote emulsion of a potential available one million gallons of free creosote beneath the former creosote pond. The three and half year pilot PAH *in-situ* groundwater biotreatment sample data have not conclusively shown that adjustments of the subsurface conditions near the on-property injection well BW-1 has enhanced the deterioration of the mobile PAHs in creosote. A pilot enhanced bioremediation program for on-property groundwater was initiated March 6, 1998 for PCP degradation.

Off-Property Groundwater Treatment

In March 1993, a six hundred (600) g.p.m. off-property P&T system began operation. The off-property P&T system was designed to remove and treat the contaminated groundwater plume that migrated off Koppers' plant property. The groundwater was pumped from two extraction wells (E-3 & E-4), located near the intersection of Prince Road and Horny Toad Road. From these extraction wells, the contaminated water flowed to the off-property P&T system and was filtered through two carbon filters in series. The treated water was then reinjected back into the groundwater basin up-gradient (North) of the extraction wells. The off-property P&T system prevented the plume from moving farther south and helped to shrink the plume to the vicinity of monitoring well RI-11. The southern edge of the off-property plume is currently located approximately half a mile up-gradient from the off-property P&T system extraction wells EW-3 and EW-4. In December 1995, the P&T system was taken off-line (held in reserve) because the system achieved the cleanup standards within its zone of capture at extraction wells EW-3 and EW-4 and was unable to affect the up-gradient residual plume. Since December 1995, these two extraction wells have remained within the cleanup standard. Monitoring wells RI-2 and RI-3 are located within the heart of the remaining residual off-property groundwater plume. Since November 1994, RI-2 and RI-3 monitoring well data has been relatively stable, with concentrations in the range of 15 to 65 parts per billion (ppb) for PCP. Monitoring and sampling data have shown that twenty-six (26) of the thirty-four (34) private drinking water wells, which had a potential impact to public health, are no longer contaminated by PCP. The residents of these twenty-six (26) private drinking water wells no longer require an alternative drinking water supply. The remaining eight (8) private drinking water wells will undergo further review and evaluation. Until the eight (8) remaining private drinking water wells are verified to have reached the cleanup criteria, these eight (8) well owners will continue to be provided with an alternative drinking water supply and receive reimbursement for water use based on a computed average usage rate. A pilot enhanced bioremediation program for off-property groundwater was initiated August 26, 1998 for PCP degradation.

C. Community Participation

The EPA has encouraged public participation throughout the RI/FS and remedial design/remedial action (RD/RA) stages of the project, in accordance with CERCLA requirements. Since the Consent Decree in 1991, a fact sheet has been issued to the public annually to address key progress points in the investigation and cleanup of the site.

Informational meetings and site tours have been held during the RD/RA phase, with representatives of public agencies and local citizen groups invited to attend.

In preparation for developing the proposed plan for this ROD Amendment, a phone survey of more than 50% of replacement water supply recipients was conducted in December 1998. The survey solicited comments on the August 1998 groundwater progress fact sheet and pending groundwater remedy changes.

The 1989 ROD and both ROD Amendments for the site have met the criteria specified in CERCLA Sections 113(k)(2)(B)(i through v) and 117(a)(1 & 2) through establishing and maintaining an administrative record; public notification and distribution of a proposed plan for public comment; and holding of a public meeting and addressing comments. Specifically for this proposed ROD Amendment #2, a proposed plan was issued in March 9, 1999 and public comment sought from March 15 through April 13, 1999. Public notice appeared in two local newspapers prior to the start of the public comment period. A formal public meeting was held March 23, 1999 and no comments against the proposed plan were presented. Media attendance at the public meeting included KHSL-TV, Enterprise Record and News and Review which provided TV and newspaper coverage of the event. A transcript of the meeting can be found in the administrative record for the site which resides at the following three locations:

Oroville Butte County Public Library	California State University	Superfund Records Center
180 Mitchell Ave	Meriam Library	95 Hawthorne Street
Oroville, CA 95966	400 West first Street	San Francisco, CA 95104
	Chico, CA 95929	

Two written comments were submitted during the public comment period; however, they did not offer comment on the proposed groundwater remedy changes. The EPA replied to the written comments by letter providing appropriate federal and State contacts. The EPA also provided copies of the letters and the EPA's response to the Agency for Toxic Substances and Disease Registry and the California Department of Health Services.

Public input on reasonably anticipated future land use was sought as part of ROD 1996 Amendment #1 when the site cleanup standards were changed to industrial and deed restrictions required to prohibit future residential development. Public input was again sought in 1999 for site deed restrictions and industrial use. No opposition to deed restrictions or continued industrial use of the land has been posed.

Public input on potential future groundwater use was sought as part of this ROD Amendment #2. No opposition was presented to amending the ROD for a TI Waiver in which groundwater would not be restored to public drinking standards in the four-acre TI Zone.

D. Basis for the ROD Amendment

The three selected groundwater remedial changes address groundwater contamination as part of the single operable unit for the Koppers site. The 1989 ROD specified P&T as the only groundwater remedy to restore groundwater to drinking water use. Amendment #2 revises the groundwater remedy selected in the 1989 Operable Unit Record of Decision to 1) provide a TI Waiver for groundwater ARARs at the former creosote pond and CELLON BLOWDOWN areas due to DNAPL contamination, 2) add enhanced *in-situ* bioremediation to the remedy to augment PCP remediation and 3) add Monitored Natural Attenuation (MNA) as a contingency remedy should enhanced *in-situ* bioremediation nutrient distribution not be fully achieved in the aquifers. The planned sequence of actions is to implement enhanced *in-situ* bioremediation on and off-property and to develop deed restriction language for the TI Zone. The EPA will review the contingency remedy option if it determines that enhanced *in-situ* bioremediation is not fully effective.

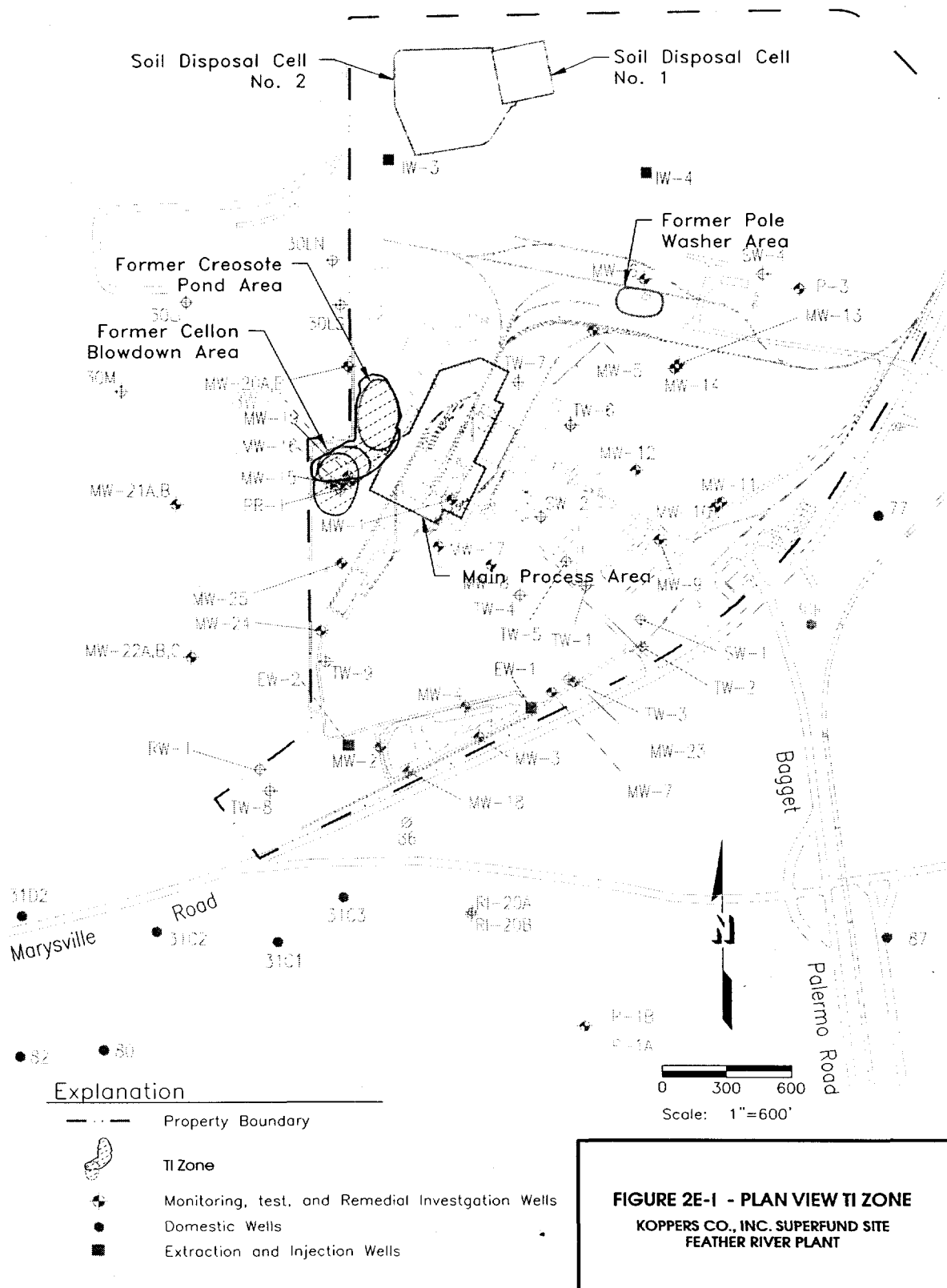
The revision to the groundwater remedy is supported by the following information:

Remedial Change 1) TI Waiver

Data defining the extent of creosote DNAPL contamination was collected as part of the RI, but the FS did not address how ARARs would be met in areas containing free residual and emulsified DNAPL. The former creosote pond and adjacent CELLON BLOWDOWN areas have had the surface and near-surface soil contamination removed; however, DNAPL contamination remains beneath and slightly down gradient, affecting approximately four acres of the 200-acre Koppers plant to a depth of 125 and possibly 250 feet below ground surface (see Figure 2E-1). The creosote DNAPL is composed of PAHs that make up the creosote and some cosolved PCP. Dioxin (PCDDs/PCDFs) also exists in the DNAPL as an impurity contained within the cosolved PCP. TI Evaluation Reference "A" provides detail on past remediation efforts and studies, DNAPL extent and appropriateness of the TI Waiver. Residual saturation will result in high concentrations of creosote persisting in soil and groundwater even though the DNAPL is no longer present in a mobile phase. The low solubility and slow dissolution rates of creosote DNAPL will persist indefinitely until a technology is developed that will remove all the DNAPL. Remedial technology is not available at this time to restore the aquifer within the TI Zone to drinking water standards, therefore, EPA has concluded that a TI Waiver is appropriate.

Remedial Change 2) Enhanced *in-situ* Bioremediation

The 1989 ROD required the groundwater restoration using P&T as the groundwater remedy. Based on wood treating site data and site specific data, the EPA has concluded that groundwater restoration for use as a public drinking water supply could be expedited significantly if enhanced *in-situ* bioremediation were added to the remedy to remediate PCP. On-property enhanced *in-situ* bioremediation would be initiated to enhance the existing P&T destruction of PCP and potentially reduce the on-property P&T operation time from 30 to 20 years. Off-property the PCP plume is no longer connected to the on-property plume due to the



effectiveness of the on-property P&T facility and the PCP plume has retreated almost half a mile up-gradient from the off-property P&T extraction wells. The off-property P&T facility was placed on standby in December 1995 and the extraction wells have remained PCP free to date. Monitoring data for the residual off-property PCP plume indicates the overall plume size and location has changed little since 1997. By adding enhanced *in-situ* bioremediation as a remedy, active remediation of the off-property PCP plume could occur faster and more cost effectively than installing new extraction and reinjection wells and piping to the existing off-property P&T facility.

Remedy Change 3) MNA As Contingency Remedy

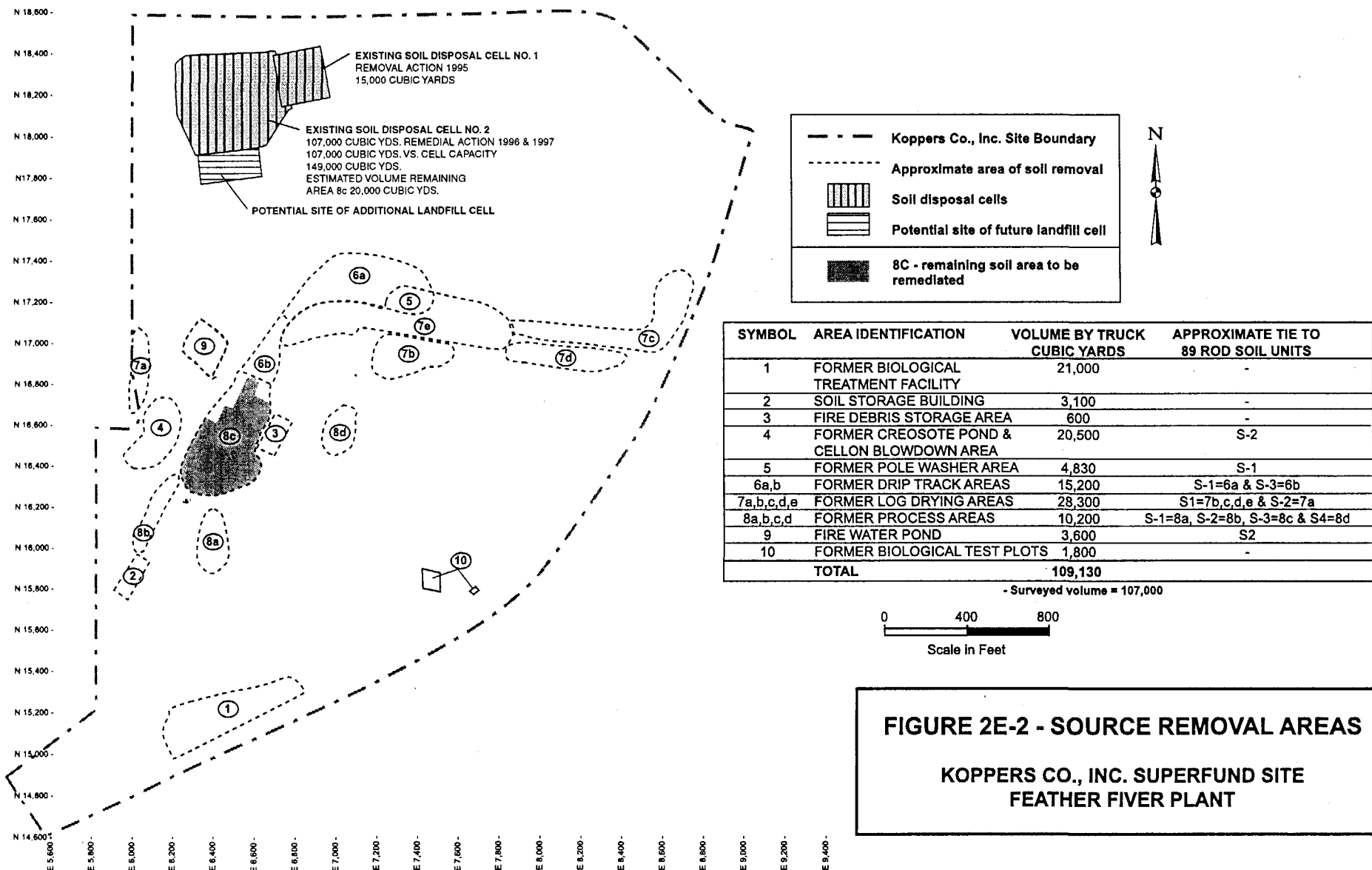
Site data has shown that PCP degradation occurs naturally both on and off-property. Provision is made for implementing MNA as a contingency remedy outside the TI Zone if EPA determines that 1) enhanced *in-situ* bioremediation nutrient distribution cannot be adequately achieved, 2) other active restoration measures are not necessary, 3) conditions off-property continue to demonstrate that PCP degradation is occurring and 4) natural attenuation is expected to achieve cleanup levels within a reasonable time frame achievable by a treatment remedy.

E. Site Characteristics

The 1989 ROD provided detailed information on the site characteristics for both soil and groundwater from the RI. The 1996 ROD Amendment #1 updated site data based on RD/RA for soils. The Site Characteristics provided under this section will address post ROD groundwater RD/RA data supporting changes to the groundwater remedy contained in the 1989 ROD and completed source area remedial actions for the site since ROD Amendment #1.

- Source Remediation - In 1996 and 1997 107,000 cubic yards of surface and near surface soils were excavated and placed in an on-property Corrective Management Unit (CMU) Cell#2 (see Figure 2E-2). The excavation completed the site soil remediation except for an estimated 20,000 cubic yards of contaminated soil remaining below the process area, designated Area 8c, which is covered by concrete foundations, asphalt roadways or chip seal. The process area cover is inspected annually. The 1989 ROD allows the process area contamination to remain in place until process area equipment is replaced or wood treating operations cease. Due to limited sampling data at the processing area, it is possible that some dioxin exceeding the 10^{-3} risk level (principle threat waste) may reside in soil under the process area. Low-level threat waste soil contaminants of concern placed in Cell #2 included PCP, PAHs, Arsenic and Chromium. Soil excavation below 5 feet occurred at the following areas and depths:
Area 4 - Former Creosote Pond excavated to a depth of approximately 13 feet below ground surface (bgs.)
Area 4 - Former CELLON BLOWDOWN area excavated to a depth of up to 10 feet bgs.
Area 5 - Former Pole Washer area excavated to a depth of up to 18 feet bgs.

Cell #2 source removal effort documentation is contained in the Construction Documentation and Closure Report for Cell #2 and Associated Soil Removal Activities dated December 1998, which will be referred to as Reference "B".



- TI Zone** - The TI Zone consists of approximately four acres covering the former creosote pond area and CELLON BLOWDOWN area described in TI Evaluation Reference "A" (see Figure 2E-2). Groundwater in the TI Zone is approximately 30 bgs. with a hydraulic gradient of from 0.001 to 0.004 ft./ft. and a groundwater flow velocity of approximately of 500 feet per year toward the south. Groundwater aquifers at the Site have been separated into A, B, and C zone aquifers with A zone above the water table on-property (see Figure 2A-3). The B zone is also divided into upper and lower B zones. Aquifer pumping tests and groundwater remediation pumping have demonstrated that, on a site-wide basis, the upper B, lower B and C zone aquifers are hydraulically connected. Within the TI Zone, however, the upper and lower B zone aquifers may be separated by a thick clay zone. Principal threat wastes in the TI Zone are high level-dioxin, cPAH and PAHs which exist in the creosote DNAPL and cosolved PCP and do not exist outside the TI Zone. The DNAPL resides on three clay layers in the TI Zone (see Figure 2A-2). The pore volume of the aquifer is estimated at approximately 67 million gallons. From RI data the area containing free creosote (exceeding residual saturation) is estimated at approximately 60,000 square feet or 1.4 acres. As much as 336,600 gallons of free creosote may be present at the base of each of the upper B, lower B and C aquifer clay layers for a total estimated free creosote of 1,009,800 gallons. The only ROD COC that have been detected directly down-gradient from the TI Zone are boron and potentially the non-carcinogenic PAH (pyrene). In the TI Zone from the December 1998 sampling, PCP ranged from 0.8 to 1,200 ppb; and total PAHs ranged from no detection to 6,980 ppb for total cPAHs and from no detection to 745,000 ppb for total non-carcinogenic PAHs.
- Groundwater** - Groundwater wells were installed to cover the extent of contamination both on and off-property and contaminant plume contours are drawn from the monitoring data taken at these wells. Individual well sampling frequency varies from quarterly to biennially depending on the well COC history. Groundwater data is collected quarterly and semiannual reports evaluate the data. Figure 2A-2 shows the extent of groundwater contamination on and off-property for PCP based on a 2.2 ppb contour line for the B aquifer from the Annual 1998 Remedial Action Groundwater Monitoring Report dated April 13, 1999, which will be referred to as 98 Groundwater Report Reference "C". Table 2E-1 provides on and off-property COC detection frequency with low to high range of readings tabulated from the Annual 1998 Groundwater Report Reference "C". PCP is the only off-property COC and contaminates the B aquifer. Off-property the PCP plume has contracted resulting in a shutdown of the off-property P&T and the plume has been relatively stable over the past few years. On-property outside the TI Zone boron, PCP, and PAH as pyrene are the only COC detected in the B aquifer (On-property the A aquifer is above the groundwater table). Pyrene was detected in a single well outside the TI Zone in the last sampling round documented in the Annual 1998 Groundwater Report Reference "C". The on-property P&T has been effective in containing contaminants on-property, preventing contaminants from feeding the off-property contamination, creating two distinct plumes from what was originally a single long plume.

Table 2E-1 1998 Groundwater Sampling Data			
Chemical	Detection Frequency	Lowest Reading	Highest Reading
<u>Off-Property</u> Pentachlorophenol	8/34	Not detected (ND)	64 ppb
<u>On-Property</u> Pentachlorophenol	23/31	ND	1,200 ppb
Isopropyl Ether	2/4	26 ppb	89 ppb
Barium	7/7	38 ppb	170 ppb
Boron	22/22	427 ppb	3,890 ppb
Arsenic	0/7	ND	ND
Chromium	0/9	ND	ND
Copper	0/7	ND	ND
Mercury	0/4	ND	ND
Benzene	3/12	ND	9 ppb*
Ethyl benzene	3/12	ND	54 ppb
Total Xylenes	3/12	ND	270 ppb
Total PAHs	5/16**	ND	745,000 ppb
Total cPAHs	5/16***	ND	6980ppb
Toxic Equiv. 2,3,7,8-TCDD (dioxin)	1/1	122,296 ppq (inside the TI Zone)	-

PAH = Polynuclear Aromatic Hydrocarbon

cPAH = Carcinogenic Polynuclear Aromatic Hydrocarbon

TCDD = Dioxin (Tetrachlorodibenzo-p-dioxin)

ppb = parts-per-billion

ppq = parts-per-quadrillion

* 9 ppb reading was the only reading outside the TI Zone - not verified in next sampling round

** only one reading outside TI Zone pyrene at 3.5 ppb - verified in the next sampling round

*** no readings outside the TI Zone

F. Current and Potential Future Site and Resource Uses

- Land Uses - The 200 acre Koppers site is an active wood treating facility for the foreseeable future. Residential areas are outside a buffer of industrial and commercial areas directly adjacent to the site. Directly to the north, east and west of the site the land is used for commercial and light industrial purposes. To the south of the site, land use is agricultural and rural residential. During the 1996 ROD Amendment #1 process elected officials and staff for Butte County and the City of Oroville were contacted and a determination was made that industrial use of the site was consistent with the City's long range plans for the area. No concerns were raised at the 1996 or 1999 public meetings on the continued industrial use of the site. Land use covenant deed restriction language is being developed by California Department of Toxic Substances Control (DTSC) restricting the 200 acre site to industrial use and restricting access to groundwater in the TI Zone.
- Groundwater Uses - Groundwater is intended for beneficial uses such as irrigation and drinking water in accordance with the water quality goals for the State of California. On and off-property surface water primarily infiltrates back to the aquifer. On-property some surface water flows to two open unlined ditches called the Louisiana-Pacific Ditch (L-P Ditch) and the Koppers Ditch. Both ditches flow to the Louisiana-Pacific Pond (L-P Pond) which has no surface discharge. During a 100 year storm event, it is possible that the L-P Pond could discharge to the Feather River. Groundwater on site is no longer used for drinking water but is used for wood treating processes. With the exception of the TI Zone, on property groundwater is expected to be restored to drinking water standards within 20 years. The portion of the groundwater aquifer below the four acre TI Zone will not be usable for drinking water for an indefinite period without new technology. South of Baggett Marysville Road (off-property) the groundwater is used for drinking water and irrigation. Presently an alternative water supply is furnished to eight drinking water well owners whose water supply wells remain out of service until they can be shown to be free of PCP. It is estimated that the off-property aquifer will be fully restored for drinking water use within 30 years with enhanced *in-situ* bioremediation.

G. Summary of Site Risks

The EPA completed an EA for the site in 1988 providing the current and potential future risks to public health from contamination at the Koppers site. The EA used results from the RI to determine the COC. The EA determined the possible exposure pathways that people could be exposed to now and in the future and calculated the risks associated with those exposures based on residential use. The EA concluded there are unacceptably high cancer and non-cancer human health risks for people using on or off-property contaminated groundwater as a drinking water source. Aggregate excess lifetime cancer risks for the maximum plausible exposure scenario, the highest exposure which is reasonably expected to occur, ranged from 1×10^{-3} , for off-property use of groundwater for drinking and domestic uses, to 8×10^{-1} for use of on-property groundwater as a source of drinking water (from Table 6-5, 1989 ROD). Both values significantly exceed EPA's

acceptable target risk range of 10^{-6} to 10^{-4} for Superfund sites. The EA also demonstrated aggregate non-cancer hazard indexes greater than one (1.0) for both scenarios, indicating the potential for non-cancer health effects from use of the groundwater for drinking water purposes, either on or off-property. It should be noted, however, that groundwater exposure routes have been reduced by removing contaminated drinking water wells from service and providing Oroville-Wyandotte Irrigation District drinking water both on and off-property. The basic conclusion of the EA that on and off-property groundwater requires remediation to minimize the potential human health risks associated from use of contaminated groundwater remains valid.

- **Human Health Risks** - Off property the only COC is PCP. On property the COC are listed in Table 2E-1 with the detection frequency and range from the Annual 1998 Groundwater Report Reference "C". On-property in the TI Zone COC include carcinogenic and high concentration PAHs, cPAH, dioxin and PCP. On-property COC outside the TI Zone above ARARs and To Be Considered (TBC) criteria include PCP and boron. Excess lifetime cancer risks for the maximum plausible exposure scenario, the highest exposure which is reasonably expected to occur, ranged from 1×10^{-3} to 8×10^{-1} from the EA. Since the EA, PCP has been classified as a carcinogen. When PCP is present at a concentration equal to the current MCL of 1 ppb, the residual excess lifetime cancer risk from drinking water usage of groundwater would be 4×10^{-6} . The primary risk for current and any future groundwater use is associated with domestic uses of contaminated drinking water.

A major assumption for the TI Waiver is that deed restrictions will be implemented to restrict groundwater use in the TI Zone. On-property outside the TI Zone major assumptions are that deed restrictions will prevent damage to installed caps, no new source of water to subsurface soils will be introduced through irrigation or other activities; and on-site disposal Cells #1 & 2 will not be breached.

- **Ecological Risks** - The COC for ecological risks are the same as listed in table 2E-1 with the exclusion of barium and isopropyl ether. The 1988 EA and the five year review conducted in December 1997 did not find ecological risk impacts. As part of the five year review, the EPA reviewed the National Pollution Discharge Elimination System discharge data records which supported the conclusion that there are no ecological risk impacts.

H. Remediation Standards

The 1989 ROD provided for restoration of groundwater for drinking water use using P&T. This ROD Amendment provides for revising the 1989 ROD to 1) change the remedy objective within the TI Zone, due to DNAPL, from groundwater restoration to contaminant containment, and 2) change outside the TI Zone two of the eight cleanup standards for groundwater while retaining the 1989 ROD standards for groundwater restoration as detailed as follows:

- TI Zone - The ARARs for groundwater cannot be achieved within the four acre TI Zone due to DNAPL contamination and the remedy is being changed to containment. The rationale for the changes are as follows: 1) surface and near surface soil contamination has been remediated and the DNAPLs are contained, 2) it is not technically feasible to meet the cleanup standards, 3) deed restrictions can provide adequate protection to control groundwater use within the TI Zone, 4) contaminants will be monitored inside and down-gradient of the TI Zone until such time as the EPA may determine that it is no longer necessary for the protection of human health and the environment, and 5) the TI Zone contingency plan includes a provision to restore operation of the on-property P&T if a contaminant is determined by the EPA to be leaving the TI Zone.
- Outside the TI Zone - As part of the ROD Amendment, a review of ARARs was conducted for groundwater cleanup levels at the Koppers site. A review of current drinking water standards compared to the 1989 ROD was conducted, along with changes in the risk assessment process since the 1989 ROD. The EPA determined that the new Federal and State MCLs for barium and PCP would become cleanup standards under this ROD amendment. No other changes are being made to the 1989 ARARs. The ARAR changes for barium and PCP do not modify the conclusion in the EA.

Barium: The 1989 ROD TBC risk based cleanup level of 680 ppb (ug/l) for barium is being changed to 1000 ppb (ug/l) to comply with the current California MCL and reflects a subsequent change in the oral reference dose for barium. The California MCL is more stringent than the Federal MCL. Consistent with the 1989 ROD, the residual non-cancer risk at this remediation standard corresponds to a hazard index of 0.4, using current standard Superfund risk assessment values and procedures. Barium removal is achieved through the existing on-property P&T system.

Pentachlorophenol: There was no MCL for PCP at the time of the 1989 ROD. The 1989 ROD groundwater cleanup value of 2.2 ppb (ug/l) for PCP is being changed to 1.0 ppb (ug/l) to comply with the new Federal MCL. Since the 1989 ROD, PCP has been classified as a carcinogen. Residual excess lifetime cancer risks from drinking water usage of groundwater cleaned to a PCP concentration of 1 ppb would be 4×10^{-6} using current standard Superfund risk assessment values and procedures. The rationale for lowering the MCL for PCP is to maintain the objective of restoring the groundwater aquifers for drinking water use. On-property PCP removal will be achieved through the existing on-property P&T facility. Amendment #2 to the ROD provides additional remedy options to the 1989 ROD to achieve faster destruction of PCP for the restoration of the groundwater aquifers for drinking water use.

Table 2H-1 - Summary of Groundwater Cleanup (CU) Value Changes			
Contaminant	1989 ROD CU Value (ppb)	Proposed CU Value (ppb)	Comment
Pentachlorophenol (PCP)	2.2	1	U.S. EPA MCL
Barium	680	1000	California MCL

I. Description of Alternatives

The remedial alternatives for ROD Amendment #2 are listed in Table 2I-1 and the cost data is provided in Tables 2I-2, 2I-3 and 2I-4. The remedial alternatives developed for each of the groundwater remedy changes are as follows:

- TI Waiver Alternatives 1 through 6
 - Alternative 1 - No Action
Operation of the existing BW-1 and PR-1 remediation well systems inside the TI Zone would be discontinued and no monitoring or institutional controls (IC) would be in place to protect public health and the environment.
 - Alternative 2 - Grout Curtain Wall
This alternative would potentially contain the DNAPL with a grout curtain wall approximately 1800 ft. long by 125 ft. deep created by grout injected into wells drilled in the ground approximately 10 ft. on centers but would not perform any treatment. The wall would be constructed in less than one year. ICs would be provided to prevent drilling of wells within the TI Zone for purpose other than monitoring or remedial activities, to prohibit use of groundwater within the TI zone except for wood-treating operations and to limit future land use to industrial. Monitoring inside and down-gradient of the TI Zone would be as long as the EPA determines is needed for protection of human health and the environment. The existing BW-1 and PR-1 remediation well systems inside the TI Zone would remain in operation.
 - Alternatives 3 - Contained Recovery of Oily Wastes (CROW) Method
This alternative would mobilize a portion of the DNAPL by thermal processes using temperatures below the boiling point of water. Approximately 275 wells would be installed at depths of up to 225 bgs. to inject heated water to mobilize the DNAPL for treatment at the existing on-property P&T. After 20 years of operation significant DNAPL would remain and the ARARs would not be achieved. ICs and monitoring as described in Alternative 2 would be implemented. Operation of the existing BW-1 and PR-1 remediation well systems inside the TI Zone would be discontinued.

- Alternative 4 - Steam Enhanced Extraction

This alternative has the potential to mobilize more DNAPL than Alternative 3 through a thermal process using steam. Steam would be injected into new wells installed around and in the TI Zone. It is anticipated the system would be operated two years. The chemical composition of the creosote at the site is such that it is anticipated that the ARARs would not be achieved. ICs and monitoring as described in Alternative 2 would be implemented. Operation of the existing BW-1 and PR-1 remediation well systems inside the TI Zone would be discontinued.

- Alternative 5 - Continued Operation of On-property P&T

The existing on-property P&T is down gradient from the TI Zone and would treat any contaminant leaving the TI Zone. However, the on-property P&T has no hydraulic influence the TI Zone DNAPLs. It is anticipated that in 30 years the ARARs will be met outside the TI Zone. The DNAPL in the TI Zone will exist for an extended period of time, well beyond 30 years. Operation of the P&T after ARARs are met outside the TI Zone will result only in treating groundwater that no longer needs treatment. ICs and monitoring as described in Alternative 2 would be implemented. The existing BW-1 and PR-1 remediation well systems inside the TI Zone would remain in operation.

- Alternative 6 - Monitors Groundwater After the On-property P&T Achieves ARARs Outside TI Zone (Selected Remedy)

Once the on-property P&T achieves ARARs, the P&T would be turned off and maintained in ready reserve for future use. Contaminants will be monitored at locations inside and down-gradient of the TI Zone for COC until such time as the EPA may determine that it is no longer necessary for the protection of human health and the environment (over a hundred years). If a contaminant was determined to be leaving the TI Zone, the on-property P&T would be reactivated to capture and treat the contaminated groundwater. Deed restrictions would be implemented as described in Alternative 2. The existing BW-1 and PR-1 remediation well systems inside the TI Zone would be remain in operation until creosote recovery is less than one gallon per year at PR-1.

- Summary of TI Waiver Alternatives 1 through 6

None of the Alternatives would restore groundwater to drinking water standards and Alternative 1 (No Action) is not protective of human health and the environment because there is no monitoring or plan of action if contaminants leave the TI Zone. Alternatives 2 through 6 would require deed restrictions and monitoring. The selected remedy Alternative 6 (Monitor Groundwater After the On-property P&T Achieves ARARs Outside TI Zone) is protective of human health and the environment (adds an additional monitoring well and a contingency plan for operation of the P&T if the EPA determines a contaminant is leaving the TI Zone), is easily implemented and cost effective.

- On-Property Groundwater Alternatives 1 through 3
 - Alternative 1 - No Action

This alternative would not provide any monitoring or groundwater treatment.
 - Alternative 2 - Supplement On-Property P&T with Enhanced in-situ Bioremediation Selected Remedy

This alternative provides for supplementing the existing P&T in remediating COCs by adding nutrients to selected groundwater wells. It is anticipated that cleanup levels would be reached in 20 years. The present on-property monitoring program would be augmented to provide well sampling to measure bioremediation progress until cleanup levels are achieved.
 - Alternative 3 - Continued Operation of the Existing On-Property P&T

This alternative provides for continued operation of the existing on-property P&T. It is estimated that cleanup levels will be achieved in 30 years. The present on-property monitoring program would be continued.
 - Summary of On-Property Groundwater Alternatives 1 through 3

The No Action alternative is not protective. Alternatives 2 and 3 will both achieve ARARs. The selected remedy Alternative 2 (Supplement On-Property P&T with Enhanced in-situ Bioremediation) has the potential to achieve ARARs the quickest and at the lowest cost.
- Off-Property Groundwater Alternatives 1 through 4
 - Alternative 1 - No Action

This alternative would not provide any monitoring. While natural attenuation of PCP will occur without monitoring drinking water wells are not being protected. It is anticipated that ARARs would be reached in 50 years with no action.
 - Alternative 2 - Modify Off-Property P&T

This alternative would install two new extraction wells off-property approximately a quarter to half a mile up-gradient of the existing P&T. Piping would be installed from the new extraction wells to the existing P&T. It is anticipated that ARARs would be reached in 30 years. The present monitoring program would be continued.
 - Alternative 3 - Enhanced *in-situ* Bioremediation

This remedy would add nutrients to existing off-property wells to enhance the remediation of PCP. It is anticipated ARARs would be reached in under 30 years. The present off-property monitoring program would be augmented to provide sampling of wells to measure bioremediation progress. If the EPA determines enhanced *in-situ* bioremediation will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

- Alternative 4 - Monitored Natural Attenuation

This remedy would provide for the use of the natural biological degradation of PCP to achieve ARARs. It is anticipated ARARs would be reached in 50 years. Site data has shown that natural biological degradation of PCP in groundwater has occurred through the shrinking of the off-property PCP plume. The present off-property monitoring program would be augmented to provide sampling of wells to measure bioremediation progress. If the EPA determines MNA will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

- Summary of Off-Property Groundwater Alternatives 1 through 4

All the alternatives, including no action, should eventually achieve the ARARs. Alternative 1 (No Action) will not protect drinking water wells because no monitoring will be performed. Alternatives 2, 3 and 4 are expected to achieve ARARs. The selected remedy Alternative 3 (Enhanced in-situ Bioremediation) is protective and the most cost effective protective alternative.

Table 2I-1 Description of Remedy Change Alternatives

TI ZONE WAIVER ALTERNATIVES					
<u>Alternative 1</u> No Action	<u>Alternative 2</u> Grout Curtain Wall	<u>Alternative 3</u> Thermal Treatment Contained Recovery of Oily Wastes Method	<u>Alternative 4</u> Thermal Treatment - Steam Enhanced Extraction	<u>Alternative 5</u> Continued Operation of On-Property P&T	<u>Alternative 6</u> Selected Remedy Monitor After P&T Achieves ARARs Outside TI Zone
ON-PROPERTY GROUNDWATER ALTERNATIVES					
<u>Alternative 1</u> No Action	<u>Alternative 2</u> Selected Remedy - Supplement On-Property P&T with Enhanced <i>in-situ</i> Bioremediation with Monitored Natural Attenuation (MNA) as Contingency Remedy	<u>Alternative 3</u> Continued Operation of On-Property P&T			
OFF-PROPERTY GROUNDWATER ALTERNATIVES					
<u>Alternative 1</u> No Action	<u>Alternative 2</u> Modify Off-Property P&T	<u>Alternative 3</u> Selected Remedy Enhanced <i>in-situ</i> Bioremediation	<u>Alternative 4</u> Contingency Remedy MNA		

TABLE 2I-2 COST OF TI ZONE WAIVER ALTERNATIVES

Remedy Cost Estimate Summary	<u>Alternative 1</u> No Action	<u>Alternative 2</u> Grout Curtain Wall	<u>Alternative 3</u> Thermal Treatment Contained Recovery of Oily Wastes Method	<u>Alternative 4</u> Thermal Treatment - Steam Enhanced Extraction	<u>Alternative 5</u> Continued Operation of On-Property P&T	<u>Alt. 6</u> Selected Remedy Monitor After P&T Achieves ARARs Outside TI Zone
Capital \$	\$0	\$22 million	\$13.75 million	\$5	\$0	\$82,500
O&M	\$0	\$0	\$955,000	\$33.5 million	\$258,000	\$12,000 (2008 thru 2018) \$20,000 (2019 thru 2037) \$ 5,000 (2038 thru 2107)
O&M period	-	\$0	20 years (1999 thru 2018)	2 years (1999 and 2000)	30 years (1999 thru 2028)	100 years (2008 thru 2107)
Discount rate	-	-	4%	4%	4%	4%
Total O&M discount rate	\$0	\$0	\$13 million	\$62 million	\$4.5 million	\$162,000
Total Present Worth Cost	\$0	\$22 million	\$26.8 million	\$67 million	\$4.5 million	\$244,500

TABLE 2I-3 COST OF ON-PROPERTY GROUNDWATER REMEDIAL CHANGE ALTERNATIVES

Remedy Cost Estimate Summary	<u>Alternative 1</u> No Action	<u>Alternative 2</u> Selected Remedy Supplement On-Property P&T with Enhanced <i>in-situ</i> Bioremediation with MNA as Contingency Remedy	<u>Alternative 3</u> Continued Operation of On-Property P&T
Capital \$	\$0	\$30,000	\$0
O&M	\$0	\$252,000 (1998 thru 2002) \$85,000 (2003 thru 2007) \$20,000 (2008 thru 2017)	\$258,000
O&M period	-	20 years (1998 thru 2017)	30 years (1999 thru 2028)
Discount rate	-	4%	4%
Total O&M discount rate	\$0	\$1.65 million	\$4.5 million
Total Present Worth Cost	\$0	\$1.7 million	\$4.5 million

TABLE 2I-4 COST OF OFF-PROPERTY GROUNDWATER REMEDIAL CHANGE ALTERNATIVES

Remedy Cost Estimate Summary	Alternative 1 No Action	Alternative 2 Modify Off-Property P&T	Alternative 3 Selected Remedy Enhanced <i>in-situ</i> Bioremediation	Alternative 4 Contingency Remedy Monitored Natural Attenuation
Capital \$	\$0	\$500,000	\$15,000	\$0
O&M	\$0	\$257,000	\$50,600 (1999 thru 2005) \$27,000 (2006 thru 2028)	\$60,000
O&M period	-	30 years (1999 thru 2028)	30 years (1999 thru 2028)	50 years (1999 thru 2048)
Discount rate	-	4%	4%	4%
Total O&M discount rate	\$0	\$4.44 million	\$591,000	\$1.3 million
Total Present Worth Cost	\$0	\$4.9 million	\$606,000	\$1.3 million

J. Comparative Analysis of Remedy Alternatives

In this section, the remedial alternatives are evaluated in relation to one another for each of the nine evaluation criteria. The comparison of alternatives is based on the nine key criteria required under the NCP and CERCLA Section 121 for use in evaluation of remedial alternatives by the EPA. A comparison analysis of remedy alternatives is provided in the following three matrix tables: 1) Comparison of TI Waiver Alternatives Table 2J-1; 2) Comparison of On-Property Groundwater Remedial Alternatives Table 2J-2; and 3) Comparison of Off-Property Groundwater Remedial Alternatives Table 2J-3.

- Overall Protection of Human Health and the Environment

TI Waiver - Alternative 1 (No Action), Alternative 3 (Contained Recovery of Oily Waste) and Alternative 4 (Steam Enhanced Extraction) are not protective of human health and the environment because DNAPL will remain to contaminate groundwater and no effective engineering or institutional controls are provided. The remaining alternatives are protective of human health and the environment by reducing or controlling risk posed by site contaminated groundwater through engineering and institutional controls inside the TI Zone. Alternative 2 (Grout Curtain Wall) would use an engineering control to provide a physical barrier to prevent groundwater migration from the TI Zone and institutional controls on access and use of groundwater inside the TI Zone. Alternative 5 (Continued Operation of the P&T) and Alternative 6 (Monitor After P&T Achieves ARARs Outside the TI Zone) provides for treatment of the contaminated groundwater leaving the TI Zone and institutional controls on access and use of groundwater inside the TI Zone.

On-Property Groundwater - Of the three alternatives for on-property groundwater only Alternative 1 (No Action) is not protective of human health and the environment because contaminated groundwater would not be treated or monitored. The remaining alternatives provide for protection of human health and the environment by reducing risk through treating the groundwater. Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) provides treatment of groundwater by P&T and bioremediation for enhanced PCP degradation. Alternative 3 (On-Property P&T) continues groundwater treatment by P&T.

Off-Property Groundwater - Of the four alternatives for off-property groundwater only Alternative 1 (No Action) is not protective of human health and the environment because contaminated groundwater would not be treated or monitored. The remaining alternatives provide for protection of human health and the environment by eliminating, reducing or controlling risks posed by the site through treatment or biological process in conjunction with monitoring. Alternative 2 (Modify Off-Property P&T) would resume treatment of groundwater by installing new extraction wells in the residual PCP plume with new piping to the existing off-property P&T. Alternative 3 (Enhanced *in-situ* Bioremediation) would expedite the biological degradation of the remaining residual PCP plume through the addition of nutrients. Alternative 4 (MNA) provides for monitoring of the natural

degradation of the remaining residual PCP plume and EPA review of remedy action if monitoring data shows MNA is not protective of public health and the environment.

- Compliance with Applicable or Relevant and Appropriate Requirements
TI Waiver - Due to DNAPL none of the six alternatives meet ARARs for the four acre TI Zone requiring a waiver for cPAH, PCP and dioxin. Because hazardous substances will remain in the TI Zone a five year review will be conducted pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c).

On-Property Groundwater - Of the three alternatives for on-property groundwater only Alternative 1 (No Action) does not comply with ARARs. Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) is expected to achieve ARARs within 20 years and Alternative 3 (On-Property P&T) within 30 years.

Off-Property Groundwater - Of the four alternatives for off-property groundwater only Alternative 1 (No Action) does not comply with ARARs because contaminated groundwater would not be monitored for protection of drinking water wells. Alternative 2 (Modify Off-Property P&T) and Alternative 3 (Enhanced *in-situ* Bioremediation) are expected to achieve ARARs within 30 years. Alternative 4 (MNA) is expected to achieve ARARs in 50 years.

- Long-Term Effectiveness and Permanence
TI Waiver - Only Alternative 1 (No Action) provides no reduction in risk over the life of the remedy. Alternative 3 and 4 (Thermal Treatments) provide some removal of DNAPL but do not restore groundwater to ROD cleanup standards. Alternative 5 (Continue Operation of P&T) and Alternative 6 (Monitor After P&T Achieves ARARs Outside of the TI Zone) do not treat DNAPL in the TI Zone but reduce risk by treating contaminants if they leave the TI Zone) and are effective over the life of the remedy. Because hazardous substances will remain in the TI Zone a five year review will be conducted pursuant to Section 121(c) of CERCLA, 42 U.S.C. 9621(c).

On-Property Groundwater - Only Alternative 1 (No Action) of the three alternatives provides no reduction in risk over the life of the remedy. Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) and Alternative 3 (On-Property P&T) will both reduce risk and be effective over the life of the remedy. Alternative 2 is expected to achieve groundwater cleanup standards for PCP 10 years sooner than Alternative 3.

Off-Property Groundwater - Only Alternative 1 (No Action) of the four alternatives provides no reduction in risk over the life of the remedy. Alternative 2 (Modify Off-Property P&T) and Alternative 3 (Enhanced *in-situ* Bioremediation) will effectively achieve cleanup standards within 30 years. The long term effectiveness of Alternative 3 depends on how well nutrients are distributed in the groundwater. Alternative 4 (MNA) monitors the natural biological degradation of PCP and the long term effectiveness will

depend on the quantity of the naturally available nutrients in the aquifer.

- Reduction of Toxicity, Mobility and Volume Through Treatment

TI Waiver - All the alternatives have a treatment component except Alternative 1 (No Action). Alternative 2 (Grout Curtain Wall), Alternative 5 (Continue Operation of P&T) and Alternative 6 (Monitor After P&T Achieves ARARs Outside of the TI Zone) provide for the continued operation of PR-1 and BW-1 in the TI Zone also, Alternative 2 reduces mobility through the construction of a physical barrier (engineering control). Alternative 3 (Contained Recovery of Oily Wastes Method) reduces 12% of the DNAPL volume over 20 years. Alternative 4 (Steam Enhanced Extraction) has the potential to reduce 85 to 90% of the DNAPL volume over two years.

On-Property Groundwater - All three Alternatives will reduce toxicity, mobility and volume. Alternative 1 (No Action) will not degrade Boron through MNA. Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) will achieve a faster degradation of PCP than Alternative 3 (On-property P&T).

Off-Property Groundwater - All four Alternative will reduce toxicity, mobility and volume. The difference between Alternative 1 (No Action) and Alternative 4 (MNA) is that the Alternative 4 provides for the monitoring of the contamination and EPA review of remedy action if monitoring data shows cleanup levels will not be accomplished in a reasonable time frame or containment is lost. Alternative 2 (Modify Off-property P&T) and Alternative 3 (Enhanced *in-situ* Bioremediation) are expected to achieve the groundwater cleanup stand for PCP 20 years faster than Alternative 1 or 4.

- Short-Term Effectiveness

TI Waiver - All the alternatives have some short term effectiveness except Alternative 1 (No Action) which can not be considered effective because there is no monitoring to insure the contaminants do not leave the TI Zone and no ICs are implemented to prevent access to groundwater for an indefinite period of time (over one hundred years) it would take for natural degradation of contaminants within the TI Zone. Alternative 1 (grout Curtain Wall) would only take a year to install and deed restrictions would control access to groundwater within the TI Zone. Alternative 3 (Contained Recovery of Oily Wastes Method) would take a year to install but would need to operate over 20 years. Alternative 4 (Steam Enhanced Extraction) would operate for 2 years injecting steam. Alternative 5 (Continue Operation of P&T) requires no new construction by the existing system would have to operate over a hundred years to capture contaminants that might leave the TI Zone. Alternative 6 (Monitor After P&T Achieves ARARs Outside the TI Zone) would not require any construction and the P&T would only be operated if contaminants were determined to be leaving the TI Zone.

On-Property Groundwater - Alternative 1 (No Action) is not effective because plume control will be lost and contaminants would be allowed to migrate off-property. Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) requires the adding of non hazardous nutrients to existing wells (new well remain an option) over a remedy life of up to 20 years. Alternative 3 (On-Property P&T) requires no new construction but the operation of the existing P&T for 30 years.

Off-Property Groundwater - All four alternatives are short-term effective. Alternative 1 (No Action) requires no construction and will have no impact to the community over the estimated 50 year PCP natural degradation period as long as the residual plume remains contained. Alternative 2 (Modify Off-Property P&T) would take a year of construction and the P&T would have to be operated an estimated 30 years. Alternative 3 (Enhanced *in-situ* Bioremediation) requires the adding of non hazardous nutrients to existing wells (new nutrient wells remain an option) over a remedy life of up to 30 years. Alternative 4 (MNA) requires no construction and will have no impact on the community over the estimated 50 year PCP natural degradation period.

- Implementability

TI Waiver - All six Alternatives are easily implemented. All materials and services required for implementation are readily available. Alternatives 3 and 4 (Thermal Treatments) use standard components, however, engineering design must be carefully done to insure that mobilized contaminants are properly controlled and captured.

On-Property Groundwater - All three Alternatives are easily implemented. Only Alternative 3 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) requires any new action and all materials and services required for implementation are readily available.

Off-Property Groundwater - All four Alternatives are easily implemented. Alternative 2 (Modify Off-Property P&T) and Alternative 3 (Enhanced *in-situ* Bioremediation) use readily available materials and services.

- Cost

TI Waiver - The estimated present worth costs for the alternatives, excluding the No Action alternative, range from \$244,500 for Alternative 6 (Monitor After P&T Achieves ARARs Outside the TI Zone) to \$67 million for Alternative 4 (Steam Enhanced Extraction) as shown on Table 2I-2.

On-Property Groundwater - The estimated present worth costs for the alternatives, excluding the No Action alternative, range from \$1.7 million for Alternative 2 (Supplement On-Property P&T with Enhanced *in-situ* Bioremediation) to \$4.5 million for Alternative 3 (Continued Operation of On-Property P&T) as shown on Table 2I-3.

Off-Property Groundwater - The estimated present worth costs for the alternatives, excluding the No Action alternative, range from \$606,000 for Alternative 3 (Enhanced *in-situ* Bioremediation) to \$4.9 million for Alternative 2 (Modify Off-Property P&T) as shown on Table 2I-4.

- State Acceptance

The State did not provide comments on the individual alternatives for remedy changes (TI Waiver, On-Property Groundwater and Off-Property Groundwater) but provided a letter of acceptance of the proposed plan and concurrence with the this ROD Amendment.

- Community Acceptance

The community during the public comment period did not provide comments on the individual alternatives for remedy changes (TI Waiver, On-Property Groundwater and Off-Property Groundwater). After the public comment period one phone comment was received against granting any TI Waiver.

TABLE 2J-1 COMPARISON OF TI WAIVER ALTERNATIVES

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Grout Curtain Wall	Alternative 3 Thermal Treatment - Contained Recovery of Oily Wastes Method	Alternative 4 Thermal Treatment - Steam Enhanced Extraction	Alternative 5 Continue Operation of P&T	Alt. 6 Selected Remedy Monitor After P&T Achieves ARARs Outside of the TI Zone
Protection of Human Health and the Environment	Does not provide overall protection of human health and the environment.	Provides moderately high degree of overall protection of human health and the environment.	Provides low degree of overall protection of human health and the environment.	Provides low degree of overall protection of human health and the environment.	Provides moderately high degree of overall protection of human health and the environment.	Provides moderately high degree of overall protection of human health and the environment.
Meet ARARs	Does not comply.	Does not comply.	Does not comply.	Does not comply.	Does not comply.	Does not comply.
Long-Term Effectiveness and Permanence	Least effective.	Does not remove DNAPL in the TI Zone but provides a physical barrier to contaminants within the TI Zone as long as cracks and fissures do not develop in the wall.	Partially effective because 12% of DNAPL would be removed over a 20 yr period. Remaining DNAPL would prevent restoration of groundwater to cleanup standards.	Moderately effective with potential for significant DNAPL removed. However, some residual DNAPL would remain preventing restoration of groundwater to cleanup standards.	Does not remove DNAPL in the TI Zone but the P&T will be able to capture any contaminants coming from the TI Zone for effective control.	Does not remove DNAPL in the TI Zone but if monitoring showed contaminants coming from the TI Zone, the P&T will be operated to achieve effective control.
Reduction of Toxicity, Mobility, or Volume	Does not reduce toxicity, mobility, or volume.	Does not reduce toxicity or volume, but effective in reducing mobility.	Effective in reducing toxicity and volume, but not effective in reducing mobility.	Effective in reducing toxicity and volume, but not effective in reducing mobility.	Does not reduce toxicity or volume, but effective in controlling mobility if contamination leaves TI Zone.	No reduction in toxicity or volume, but effective in controlling contamination leaving TI Zone.
Short-Term Effectiveness	Not effective - DNAPL may not remain contained and no IC to prevent exposure.	Effective with only one year for installation, but requires adherence to a health and safety plan.	Limited short term effectiveness due to 20 yr. duration of remedial action. Requires adherence to a health and safety plan.	Effective, but requires adherence to a health and safety plan during two years of steam injection.	The P&T is already in place but the operation period would be over 100 years	Highly effective. P&T would be maintained ready for reactivation if contamination left TI Zone.
Implementability	Easy to implement because no action required.	Implement able, but suitability of the soil condition must be evaluated for wall construction.	Difficult to implement technically due to depth of DNAPL. Bench scale testing & computer modeling indicated 12% to 65% of free creosote could be removed within 20 years. Pilot scale test is required.	Difficult to Implement technically because of existence of DNAPL in deeper depths. A pilot scale treatability test is required.	Easy to implement P&T already in place & operating.	Easy to implement requires only maintenance of existing P&T.
Total Present Worth Cost	\$0	\$22 million	\$26.8 million	\$67 million	\$4.5 million	\$0.25 million

TABLE 2J-2 COMPARISON OF ON-PROPERTY GROUNDWATER REMEDIAL ALTERNATIVES

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Selected Remedy Supplement On-Property P&T with Enhanced <i>in-situ</i> Bioremediation with Monitored Natural Attenuation as Contingency Remedy	Alternative 3 On-Property P&T
Protection of Human Health and the Environment	Does not provide overall protection of human health and the environment.	Provides high degree of overall protection of human health and the environment.	Provides high degree of overall protection of human health and the environment.
ARARs Compliance	Does not comply.	Complies.	Complies.
Long-Term Effectiveness and Permanence	Least effective.	Effective as the PCP in the plume will be removed by P&T and then be biodegraded to nonhazardous substance by added nutrients and natural attenuation. Long term effectiveness will depend on how well the added nutrients are distributed in the groundwater for them to act on the PCP. MNA needed as contingency if not all portions of the plume receive nutrients.	Effective as shown by existing P&T.
Reduction of Toxicity, Mobility, or Volume	Partially effective in reducing toxicity, mobility, or volume due to natural attenuation of PCP.	Effective in reducing toxicity, mobility, or volume.	Effective in reducing toxicity, mobility, or volume.
Short-Term Effectiveness	Not effective - Present P&T plume control would be lost..	Effective, but requires adherence to a health and safety plan.	Effective, but requires adherence to a health and safety plan.
Implementability Short-Term Effectiveness	Easy to implement because no action required.	Easy to implement. However, duration of remediation is not known now, but can be estimated using monitoring data collected during the progress of remedial (enhanced bio and natural attenuation) actions.	Easy to implement as P&T already in place and operation.
Total Present Worth Cost	\$0	\$1.7 million	\$4.5 million

TABLE 2J-3 COMPARISON OF OFF-PROPERTY GROUNDWATER REMEDIAL ALTERNATIVES

Evaluation Criteria	<u>Alternative 1</u> No Action	<u>Alternative 2</u> Modify Off-Property P&T	<u>Alternative 3</u> Selected Remedy Enhanced <i>in-situ</i> Bioremediation	<u>Alternative 4</u> Contingency Remedy Monitored Natural Attenuation
Protection of Human Health and the Environment	Does not provide overall protection of human health and the environment.	Provides high degree of overall protection of human health and the environment.	Provides moderately high degree of overall protection of human health and the environment.	Provides overall protection of human health and the environment thru monitoring & EPA review of remedy action.
ARARs Compliance	Does not comply.	Complies.	Complies.	Complies.
Long-Term Effectiveness and Permanence	Least effective.	Effective as shown by existing P&T.	Effective as the PCP in the plume will be biodegraded to nonhazardous substance by the added nutrients. Long term effectiveness will depend on how well nutrients are distributed in the groundwater for them to act on the PCP.	Moderately effective. PCP in the plume will be biodegraded to nonhazardous substance by natural biological condition of the aquifer. Long term effectiveness will depend on the quantity of the naturally available nutrients in the aquifer.
Reduction of Toxicity, Mobility, or Volume	Partly effective in reducing toxicity, mobility, or volume due to natural attenuation.	Effective in reducing toxicity, mobility, or volume.	Effective in reducing toxicity, mobility, or volume.	Moderately effective in reducing toxicity, mobility, or volume.
Short-Term Effectiveness	Highly effective as no construction needs to be performed.	Effective, but requires adherence to a health and safety plan.	Effective, but requires adherence to a health and safety plan.	Effective.
Implementability	Easy to implement because no action required.	Easy to implement as P&T already in place and operation.	Easy to implement. However, duration of remediation is not known now, but can be estimated using monitoring data collected during the progress of remedial action.	Easy to implement. However, duration of remediation is not known now, but can be estimated using monitoring data collected during the progress of natural attenuation.
Total Present Worth Cost	\$0	\$4.9 million	\$0.6 million	\$1.3 million

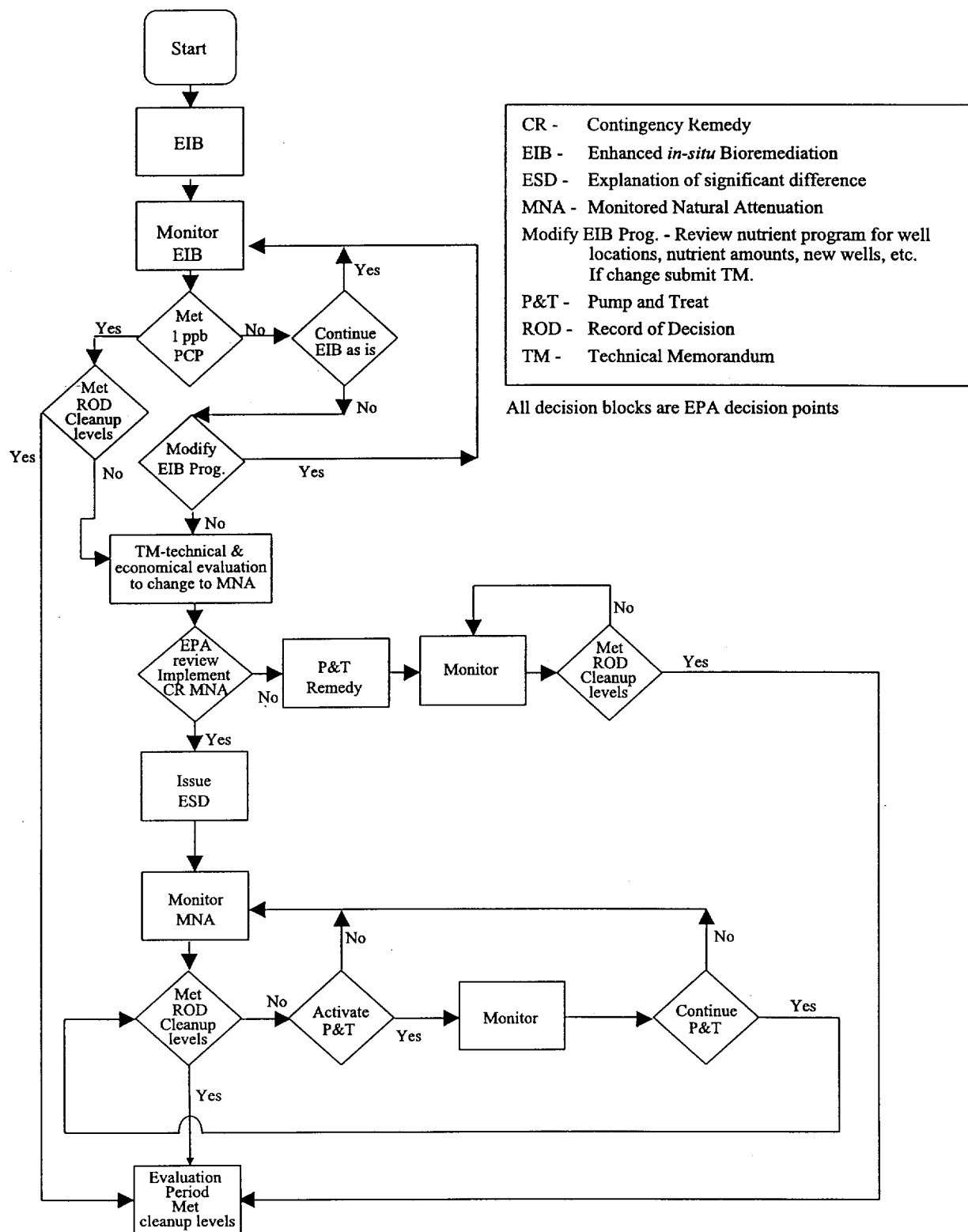
K. Selected Remedy

The following sections describe the modifications to the 1989 ROD, including the waiver of the cleanup standards for the TI Zone, and additional enhancements and modifications. Table 2L-1 summarizes the Applicable or Relevant and Appropriate Requirements (ARARs) for groundwater and provides the cleanup standard for COCs.

- Technical Impracticability Waiver (Remedy Change On-Property Alternative 6, TI Waiver)
 - Contaminants will be monitored inside and down-gradient of the TI Zone until such time as the EPA may determine that it is no longer necessary for the protection of human health and the environment. Monitoring will be conducted at the locations and frequency specified in TI Evaluation Reference "A". The EPA reserves the right to modify TI Evaluation Reference "A" as necessary based on the latest site data. Once the on-property P&T facility is placed in standby reserve, operation will resume if 95% of the upper confidence limit of the mean for four consecutive sampling events for a COC exceeds the ROD standard. If a contaminant is detected outside the TI Zone, sample frequency for the contaminant will change to quarterly. After four consecutive quarters of non-detect the sampling frequency may revert to the next monitoring plan level. Monitoring data will be submitted with the Remedial Action Groundwater Monitoring Report submittal or another approved reporting mechanism.
 - Install one new monitoring well down-gradient of the TI Zone in aquifer B. A minimum of one year of monitoring data from the new well will be incorporated in the data to establish cleanup levels have been met outside the TI Zone prior to placing the on-property P&T facility in standby reserve.
 - Six months prior to placing the P&T facility on standby reserve, a detailed contingency plan will be submitted to the EPA for approval. The TI Zone contingency plan will describe the activities necessary to maintain the on-property P&T facility in good working order with the ability to resume normal operations within one month of determination that COC are leaving the TI Zone.
 - Six months prior to placing the P&T facility on standby reserve the TI Zone monitoring plan provided in TI Evaluation Reference "A" will be reviewed and updated as necessary for EPA approval.
 - Operation of the existing Product Recovery well (PR-1) and the PAH *in-situ* groundwater bioremediation well (BW-1) will continue until creosote recovery is less than one gallon per year at PR-1.
 - Institutional controls in the form of deed restrictions will be developed to prevent access to groundwater, surface disturbance and the addition of new sources of surface water to groundwater in the TI Zone. Access to groundwater for wood treating operations,

Superfund remediation and Superfund monitoring will be an authorized exclusion. Land use covenant deed restrictions will be prepared in accordance with DTSC guidance. DTSC will oversee and approve the preparation and recording of the deed restrictions by the property owner.

- Enhanced *in-situ* Bioremediation (Selected Remedy On-Property Alternative 2 and Off-Property Alternative 3)
 - Nutrients will be added to monitoring wells in accordance with proposals from HSI Geotrans 1) June 10, 1998 Revised Off-Property Groundwater *in-situ* Bioremediation Program and 2) August 21, 1997 On-Property Groundwater *in-situ* Bioremediation Program or latest EPA approved modification of either document. Existing wells will be utilized on and off-property for nutrient addition (primarily oxygen, nitrogen and phosphorus) to provide optimum conditions for PCP degradation in conjunction with down-gradient monitoring. As indicated in Figure 2K-1, provision is made for the addition of new wells for nutrient addition should field conditions warrant. The enhanced *in-situ* bioremediation program integrates with the other ROD remedies as shown on Figure 2K-1.
 - The existing on-property P&T facility will remain in operation during the on-property enhanced *in-situ* bioremediation program to restore groundwater on-property and prevent contaminants from migrating off-property and feeding the off-property plume. The on-property P&T will remain in operation until the EPA confirms that cleanup levels are met on-property, outside the TI Zone.
 - An annual evaluation of the on and off-property enhanced *in-situ* bioremediation program, including adjustments, as necessary, to nutrient frequency and quantity to maintain optimum PCP degradation will be conducted and submitted to the EPA for approval. Unless another reporting mechanism is approved, enhanced *in-situ* bioremediation monitoring data and status will be provided as part of the Remedial Action Groundwater Monitoring Reports, including the annual evaluation.
 - The off-property enhanced *in-situ* bioremediation program will be used as the primary method to destroy the remaining PCP in groundwater. However, P&T still remains a remedy option.
 - Due to nutrient addition to monitoring well RI-11 the alternative water supply termination criteria (AWSTC) for water supply wells 59, 60, 61, 62 and 81 is modified as follows: 1) verification sampling for PCP to end the subsidy cannot be conducted until nutrient addition in the area of these wells has been terminated and nutrient levels have returned to background levels for at least one year and 2) to end the subsidy for each individual drinking water well the PCP level must be less than 0.5 ppb for four consecutive quarters.



**Figure 2K-1 - Flow Chart for EIB and MNA Implementation On and Off-Property Plumes
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If the EPA determines enhanced *in-situ* bioremediation will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

- Monitored Natural Attenuation As Contingency Remedy (Selected Contingency Remedy On-Property Alternative 2 and Off-Property Alternative 4)
 - Provision is made for implementing MNA as a contingency remedy on and off-property if the EPA determines that 1) enhanced *in-situ* bioremediation nutrient distribution cannot be adequately achieved, 2) other active restoration measures are not necessary, 3) conditions on and off-property continue to demonstrate that PCP degradation is occurring and 4) natural attenuation is expected to achieve cleanup levels within a reasonable time frame achievable by a treatment remedy. The MNA remedy integrates with the other remedies as shown on Figure 2K-1.
 - If the MNA contingency remedy is implemented, a monitoring plan will be developed for EPA approval.
 - If the EPA determines MNA will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

L. Statutory Determinations

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action must comply with applicable or relevant and appropriate environmental standards established under federal and State environmental laws unless a waiver is justified. The selected remedy must also be cost-effective and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following section discuss how the selected remedy addresses these statutory requirements and preferences.

- Protection of Human Health and the Environment

TI Waiver - Waiving the groundwater ARARs for contaminants of concern (dioxin, cPAHs, and PCP) for the four acre TI Zone is still protective of human health because 1) surface and near surface soil contamination has been remediated, preventing worker exposure in the TI Zone and further contamination of the aquifer, 2) the DNAPLs are contained based on monitoring data down gradient, 3) an additional monitoring well will be installed prior to

taking the P&T offline and placing it in a maintained ready reserve state, 4) deed restrictions will be implemented to control access to groundwater under the TI Zone, 5) the groundwater in the TI Zone and down gradient of the TI Zone will be monitored and evaluated semi-annually prior to placing the P&T in ready reserve and then annually until such time as EPA may determine that it is no longer necessary for the protection of human health and the environment, 6) the TI Zone is down gradient from the on-property P&T and the TI Zone contingency plan makes provision to maintain and then operate the on-property P&T if a contaminant is determined to be leaving the TI Zone and 7) remedy effectiveness will be reviewed at least every five years.

Because this remedy will result in contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory Five-Year review will be conducted within five years of the commencement of this amended remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Enhanced in-situ Bioremediation On and Off-Property - The nutrient added to enhance PCP degradation are not harmful to human health in the quantities used and nutrient concentration in groundwater will be monitored. The process uses bacteria already available in the soil. The addition of the nutrients on-and off property has the potential to reduce the remediation effort significantly, allowing early return of the drinking water aquifer. On-property enhanced in-situ bioremediation will supplement the existing P&T. If the EPA determines enhanced *in-situ* bioremediation will not achieve cleanup standards or that migration of a contaminant is occurring, the EPA will select appropriate contingency action in accordance with remedies available in the ROD.

MNA As Contingency Remedy - Natural attenuation if implemented as a contingency remedy is protective of public health because 1) the monitoring will continue until it has been demonstrated that ARARs have been achieved, 2) MNA will be implemented only for contained or shrinking PCP plumes, 3) natural attenuation is expected to achieve cleanup levels within a reasonable time frame achievable by a treatment remedy (see Figure 2K-1), and 4) the EPA will review remedy action if monitoring data shows that a contaminant threatens water supply wells or cleanup levels will not be met.

■ Compliance with ARARs

This ROD Amendment modifies the groundwater remedy selected in the 1989 ROD and documents a waiver of the groundwater cleanup standards for all areas within the TI Zone. The EPA has waived the ARARs that apply to the TI Zone because it is technically impracticable, from an engineering perspective, to meet the standards. See, CERCLA section 121(d)(4)(c), 42 U.S.C. Section 9621(d)(4)(c). This ROD Amendment will not affect the ARARs selected for the Soils Remedy (ROD Amendment #1 1996); however, it will affect groundwater ARARs outside the TI Zone by changing the MCL for Barium and PCP.

Remedial actions selected under CERCLA must comply with all ARARs under federal environmental laws or, where more stringent than the federal requirements, State or State subdivision environmental or facility siting laws. Where a State is delegated authority to enforce a federal statute, such as RCRA, the delegated portions of the statute are considered to be a Federal ARAR unless the State law is broader or more stringent than the federal law. Applicable or relevant and appropriate requirements are identified on a site-specific basis from information about site-specific chemicals, specific actions that are being considered, and specific features of the site location. There are three categories of ARARs: (1) chemical-specific requirements; (2) action-specific requirements; and (3) location-specific requirements. Where no ARARs exist for a given chemical, action or location, EPA may consider non-promulgated federal or State advisories and guidance as To Be Considered criteria (TBC). Although consideration of a TBC is not required, if standards are selected based on TBC, those standards are legally enforceable.

Chemical-specific ARARs are risk-based cleanup standards or methodologies which, when applied to site-specific conditions, result in the development of cleanup standards for COC.

Location-specific ARARs are restrictions placed on concentrations of hazardous substances or the conduct of activities because of the special locations, which have important geographical, biological or cultural features. Examples of special locations include wetlands, flood plains, sensitive ecosystems and seismic areas.

Action-specific ARARs are technology-based or activity-based requirements or limitations on actions to be taken to handle hazardous wastes. They are triggered by the particular remedial activities selected to accomplish a remedy.

The ARARs adopted in the 1989 ROD were “frozen” as of the date EPA signed the ROD. The ARARs are being modified in this ROD Amendment in the following three respects: 1) modification to the groundwater remedy requires a waiver of all ARARs within the TI Zone, 2) the this ROD Amendment provides for new remedial activities that require the adoption of additional action specific ARARs and 3) this ROD Amendment incorporates newly promulgated requirements that are necessary to ensure the protectiveness of the selected remedy. See 40 CFR Section 300.430(f)(ii)(B); 55 Federal Register 8747, 8758 (March 8, 1990). The ARARs for this ROD Amendment are identified in Table 2L-1.

Table 2L-1 Applicable or Relevant and Appropriate Requirements for Groundwater ROD Amendment

Source	Standard, Requirement, Criterion, or Limitation	Applicable or Relevant and Appropriate	ARAR or Performance Standard Applicability
Porter-Cologne Water Quality Control Act (California Water Code Sections 13000, 13140, 13240, 13260, 13263, 13267, 13300, 13394, 13307).	State Water Resources control Board Resolution No. 92-49 (as amended April 21, 1994) (Subparagraph IIIG)	Relevant and Appropriate	Applies to groundwater remedial actions. The groundwater cleanup system will be operated in such a way that the best water quality reasonable is restored.
Porter-Cologne Water Quality Control Act (California Water Code Sections 13140-13147, 13172, 13260, 13262, 13267, 13304	Title 27, CCR, Section 20410, Title 23, CCR, Section 2550.6	Applicable	Applies to groundwater remediation and monitoring of sites. Groundwater will be remediated and monitored according to Title 27/Title 23 regulations.
Safe Drinking Water Act (40 U.S.C. 300 et seq.).	National Primary Drinking Water Standards (40 CFR Part 141)	Relevant and Appropriate	Chemical-specific drinking water standard MCLs have been promulgated under the Safe Drinking Water Act (SDWA). Drinking-water MCL standards has also been promulgated under the SDWA. MCLGs above zero are considered chemical-specific ARAR under the NCP (40 CFR 300.430(e)(2)(I)(B)). When the MCLGs are equal to zero (which is generally the case for chemical considered to be a carcinogen), the MCL is considered to be a chemical-specific ARAR, instead of the MCLG (40 CFR 300.430(e)(2)(I)(C)). In 1989, a Federal MCL for PCP did not exist. A Federal MCL for PCP was recently set at 1 ppb. This MCL is waived in the TI Zone.

Table Continued

Source	Standard, Requirement, Criterion, or Limitation	Applicable or Relevant and Appropriate	ARAR or Performance Standard Applicability
<p>California Safe Drinking Water Act CCR Title 22, Division 4, Chapter 15, Articles 4, 5.5, and 8.</p> <p>Table Continued</p>		<p>Relevant and Appropriate</p>	<p>California primary drinking water standards establish enforceable limits for chemicals that may affect public health or the aesthetic qualities of drinking water. However, only those State requirements that are more stringent than federal standards are ARARs. Recently, a State MCL for barium was changed to 1000 ppb.</p>
<p>Hazardous Waste Control Act (California Health and Safety Code 25100 et seq.).</p> <p>Table Continued</p>	<p>27 CCR, Division 2, Subdivision 1.</p>	<p>Applicable</p>	<p>Title 27 establishes waste and siting classification systems and minimum waste management standards for discharges of waste to land for treatment, storage, and disposal. Title 27 also contains corrective action provisions for responding to leaks and other unauthorized discharges. Spent GAC will be classified and handled in accordance with Title 27 requirements.</p>

Source	Standard, Requirement, Criterion, or Limitation	Applicable or Relevant and Appropriate	ARAR or Performance Standard Applicability
Resource Conservation and Recovery Act Subpart AA (22 CCR 66265.1030 et seq.).	Article 27 Air Emission Standards for Process Vents (22 CCR 66265.1030-66265.1035).	Relevant and Appropriate	Applies to treatment, storage, and disposal facilities with process vents associated with solvent extraction or air or steam stripping operations managing RCRA hazardous wastes with organic concentrations of at least 10 ppm. These operations must reduce total organic emissions below specified device to reduce total organic emissions by 95 percent by weight. The requirements are relevant and appropriate for groundwater extraction and air-stripping operations.
Table Continued			

Based on the above ARARs analysis the cleanup standards that must be met for the COC outside the TI Waiver Zone are set forth in the following table.

Table 2L-2 Cleanup Standard for Chemicals of Concern (COC) Outside the TI Zone		
COC	Remedial Action Level	ARAR or Performance Standard Applicability
Pentachlorophenol	1 ppb* **	Fed. MCL
Isopropyl Ether	2,800 ppb	TBC from 1989 ROD
Barium	1,000 ppb*	Calif. MCL
Boron	1,200 ppb	TBC from 1989 ROD
Arsenic	Background (27 ug/L)	Remedial standard, 1989 ROD
Chromium	50 ppb	Calif. MCL
PCDDs/PCDFs (dioxin) as 2,3,7,8-TCDD Toxic Equivalency Factor	5.3x10 ⁻⁷ ppb**	Remedial standard, 1989 ROD
Total cPAHs	0.007 ppb**	Remedial standard, 1989 ROD

* update from remediation standard in 1989 ROD - other standards unchanged

** waived for TI Zone

Waiver of Groundwater Cleanup ARARs

In this ROD Amendment, EPA concludes that it is technically impracticable from an engineering perspective to achieve cleanup standards for groundwater within the TI Zone. Groundwater outside the TI Zone will be remediated to the ROD cleanup standards.

The EPA is invoking a waiver of groundwater cleanup ARARs in the TI Zone because contaminant and hydrogeologic conditions inhibit restoration. Pentachlorophenol and creosote, as DNAPL, are present in the TI Zone. The presence of a DNAPL, combined with the very low permeability clay present in the TI Zone, makes groundwater restoration within the Zone technically impracticable given current technologies. The factual basis for the TI Waiver is set forth in more detail in TI Evaluation Reference "A".

The EPA's long term objective is to address contamination situations which pose an actual or potential threat to groundwater resources. DNAPL remediation options beyond pump and treat have historically been limited. Recent developments suggest that alternatives are emerging which will allow effective removal of DNAPL contamination, eliminating the need for or reducing the duration of pump and treat operations. EPA intends to review the technical impracticability of remediation as additional information and experience becomes available.

- **Cost-Effectiveness** - Cost-effectiveness is determined by evaluating three of the balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness). Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective.

TI Waiver - Only Alternative 2 (Grout Curtain Wall) has long-term effectiveness. Alternatives 3 & 4 (Thermal Treatments) both reduce toxicity and volume but not mobility and Alternative 5 (Continued Operation of On-Property P&T) only reduces toxicity. Alternative 5 (Continued Operation of On-Property P&T) can reduce toxicity but once the ARARs are met outside the TI Zone the P&T will be wastefully treating clean water for a significant period of time. The treatment technologies have the potential to contaminate clean areas and leave significant contamination in-place. Alternative 5 (Continued Operation of On-Property P&T) and 6 (Monitor After P&T Achieves ARARs) have the highest short-term effectiveness because they required the least disruption. Alternatives 2 (Grout Curtain Wall) and 4 (Steam Enhanced Extraction) pose some hazard during implementation. Alternative 3 (Contained Recovery of Oily Wastes Method) has the lowest short-term effectiveness due to the duration of remedial action. The total cost of the treatment alternatives run 18 to 268 times more expensive than the selected remedy Alternative 6 (Monitor After P&T Achieves ARARs).

On-Property Groundwater Remedy Change - Alternatives 2 (On-Property P&T with Enhanced *in-situ* Bioremediation) and 3 (Continued Operation of On-Property P&T) are both effective long-term and both reduce toxicity, volume and mobility but Alternative 2 (On-Property P&T with Enhanced *in-situ* Bioremediation) has the potential to restore groundwater twice as fast. Both Alternates 2 and 3 have good short-term effectiveness. The total cost of the selected remedy, Alternative 2 (On-Property P&T with Enhanced *in-situ* Bioremediation), is less than half the cost of Alternative 3 (Continued Operation of On-Property P&T).

Off-Property Groundwater Remedy Change - Alternatives 2 (Modify Off-Property P&T) and 3 (Enhanced *in-situ* Bioremediation) are both effective in long-term and both reduce toxicity, volume and mobility. Alternatives 3 (Enhanced *in-situ* Bioremediation) and 4 (MNA) were the most effective in the short-term due to minimal implementation impacts than Alternative 2 (Modify Off-Property P&T). The total cost of the selected remedy, Alternative 3 (Enhanced *in-situ* Bioremediation), is 2 to 8 times less than the other alternatives.

- Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

TI Waiver - The EPA has determined that the selected remedy (Alternative #6 - Monitor After P&T Achieves ARARs Outside of the TI Zone) represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for groundwater at the Koppers site. Of the alternatives evaluated, EPA has determined that the selected remedy provides the best balance of tradeoffs in terms of the nine criteria used for remedy selection. In particular, this remedy represents the best balance among long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, implementability, short-term effectiveness, and cost.

The selected remedy for the TI Zone does result in some treatment of contaminants through the continued operation of the Product Recovery well (PR-1) and the PAH *in-situ* groundwater bioremediation well (BW-1). Some TI Zone DNAPL contamination will degrade over time through biological action. The alternative remedies reviewed cannot remove all the DNAPL and thus, the drinking water aquifer will not be restored. DNAPL remediation options with present day technology have been limited and will continue to be reviewed as new technologies emerge.

On-Property Groundwater Remedy Change - The selected remedy (Alternative 2 - On-Property P&T with Enhanced Bioremediation) will provide a permanent solution for groundwater restoration to the maximum extent possible outside the TI Zone. The intent of supplementing the P&T is to speedup the groundwater restoration through the early destruction of PCP.

Off-Property Groundwater Remedy Change - The selected remedy (Alternative 3 - Enhanced *in-situ* Bioremediation) will provide a permanent solution to the maximum extent possible. Site data has shown that nutrient addition will aid in the destruction of PCP, the remaining COC off-property.

■ Preference for Treatment as a Principal Element

TI Waiver - Although contaminated groundwaters generally are not considered to be principal threat wastes, DNAPLs may be viewed as a principal threat waste because of their potential to be sources of toxic contaminants to groundwater. For this reason, the EPA expects to remove or treat DNAPLs to the extent practicable which is being accomplished at Koppers site through the continued operation of 1) the existing product recovery well (PR-1) for removal of mobile creosote DNAPL and 2) the existing *in-situ* groundwater bioremediation well system (BW-1) for bioremediation of PAHs. However, as previously stated the available treatment technologies are not capable of removing and treating all of the DNAPLs necessary to allow attainment of ARARs/groundwater restoration in the TI Zone. The EPA expects that the PR-1, BW-1 efforts with monitoring inside and down gradient of the TI Zone represent adequate control for migration and continued reduction of DNAPLs. The selected groundwater remedy (Alternative #6 - Monitor After P&T Achieves ARARs Outside of the TI Zone) for the TI Zone uses containment and monitoring, rather than treatment, to address the threats posed by DNAPL in the TI Zone. The available treatment technologies will not achieve the restoration of drinking water standards within the TI Zone after significant capital investment. Until a technology is available that will remove all the DNAPL, this zone cannot be restored to drinking water standards.

On-Property Groundwater Remedy Change - The selected remedy (Alternative 2 - On-Property P&T with Enhanced Bioremediation) is a treatment that has been demonstrated to be effective on site.

Off-Property Groundwater Remedy Change - The selected remedy (Alternative 3 - Enhanced *in-situ* Bioremediation) is a treatment that has been demonstrated to be effective on site.

M. Documentation of Significant Changes from Preferred Alternative of the Proposed Plan

In the absence of public comments and/or any new information regarding the remedial alternatives or site characteristics, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

PART 3: RESPONSIVENESS SUMMARY

A. Stakeholder Issues and EPA Responses

As described in Part 2(C) the issues raised by the community stakeholders did not directly address the Proposed Plan. During the phone survey conducted in December 1998 one individual felt his water subsidy should have been for life vs. ending when it was determined that his water supply well was free of contaminants from Koppers. No expressed opposition to the proposed plan was received at the public meeting held March 9, 1999. Only two comments were received during the 30 day comment period March 15 through April 13, 1999 even though 400 fact sheets had been mailed and the public meeting presentation was well covered by the media (local newspaper articles and local TV evening and morning news spots). Of the two comments received during the public comment period, one expressed a concern of excess cancer deaths north of the site and one expressed concern for protection, compensation and education of the Koppers employees of site dangers. Both written comments were answered individually by letter April 23, 1999 providing answers to questions and points of contact for questions outside Superfund. No further information was requested by the responders. After the public comment period one phone call was received, in which the caller expressed the view that public participation was light because of the deaths of the active community members and that the TI Waiver should not be approved because the contamination would be forgotten over time and would be allowed to re-contaminate the water supply. The call was responded to by phone and a description of the monitoring and review process for the TI Waiver was explained.

The California Regional Water Quality Control Board Central Valley Region and the California Department of Toxic Substances Control individually replied by letters dated May 10, 1999 concurring with the three remedy changes contained in the Proposed Plan.

B. Technical and Legal Issues

No technical or legal issues were raised by the stakeholders during the public comment period. The single oral comment received after the public comment period pertaining to allowing re-contamination of groundwater from the TI Zone is addressed in Part 2(K).